

Fermi Unit 3

***NRC Onsite Review
Geotechnical / Hydrogeology
Investigation Activities
July 10-11, 2007***

Project Introduction & Agenda

- **Project Introduction** – Peter Smith (Detroit Edison)
- **Project Organization and QA** – Peter Smith (Detroit Edison)/
Rob Crandall (Black & Veatch)
- **Site Investigations Overview** – Ed Meyer (Black & Veatch)
- **Regional Geology Overview** - Kathryn Hanson (Geomatrix)
- **Site Geology Overview** – Gregory Ohlmacher (Black & Veatch)
- **Subsurface Investigations Overview** – Ed Meyer (Black & Veatch)
- **Preliminary Geology Findings** – Gregory Ohlmacher (Black & Veatch)
- **Field Procedures Overview** – Gregory Ohlmacher (Black & Veatch)
- **Site Orientation** – Barry Gustafson (Black & Veatch)

Project Background

Develop COL Application based on RTV Common followed by RTV Specific Geotechnical Investigations

March, 2007	DTE Contract w/ Black & Veatch to Develop COL Application
May, 2007	Initiated RTV Qualification Process
June, 2007	Initiate RTV Common Geotechnical Investigation
November, 2007	Initiate RTV Specific Investigation

Overview of Current Status

- **Hydrogeology Investigation**
 - All monitoring wells installed.
 - Monthly groundwater measurements and groundwater sampling continuing.
- **Geotechnical Investigation**
 - Geotechnical borings begun June 12th, 2007.
 - Seismic testing to be completed.
- **COLA Development in Process**

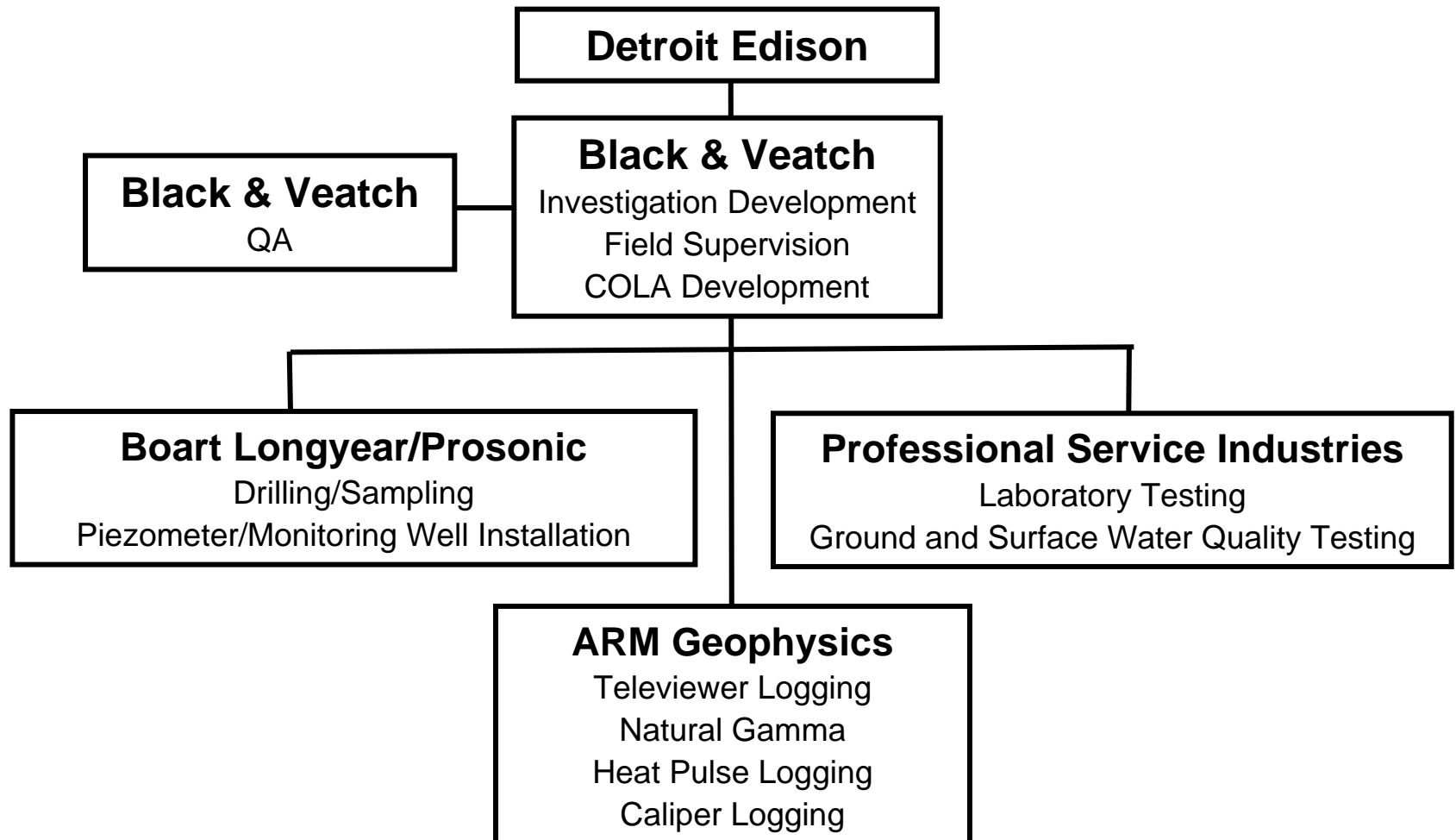
Project Organization and QA

Peter Smith
Fermi 3 COLA
Project Manager
(Detroit Edison)

Rob Crandall
Fermi 3 COLA
Project Manager
(Black & Veatch)

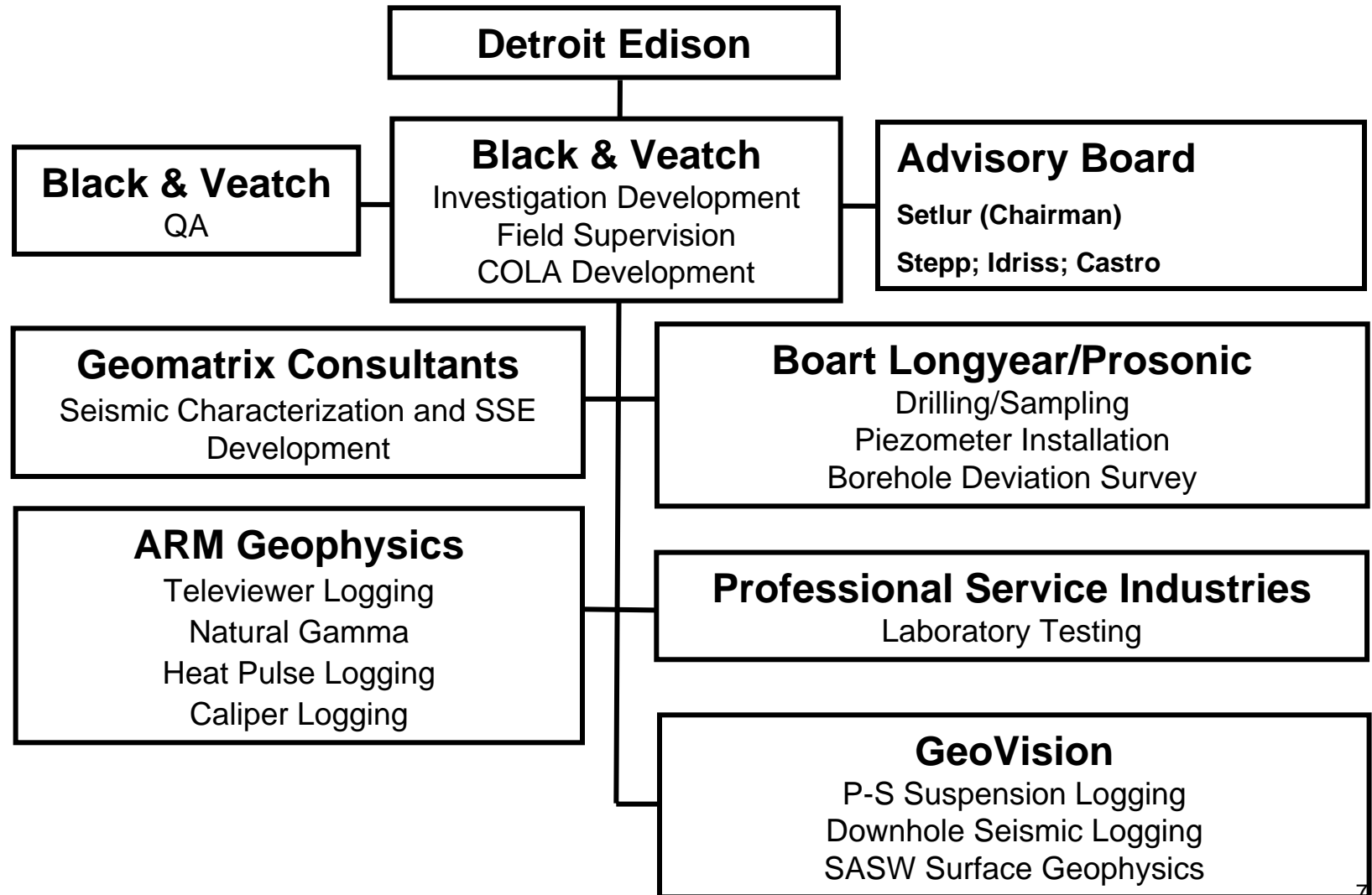
Project Organization

Hydrogeology Investigation



Project Organization

Geotechnical Investigation



Project Organization - Responsibilities

- Detroit Edison
 - Site owner
- Technical Advisory Board
 - Provides independent review of geotechnical and seismological investigations and analysis.
- Black & Veatch
 - COL Application contractor
 - Provides overall technical direction and engineering for hydrogeology and geotechnical investigations
 - Coordinates and manages field investigation activities
 - Provides QA oversight for field investigation activities as well as manages interface with site owner
 - Provides Geotechnical Engineer or Geologist assigned full-time to each drill rig for technical direction and oversight

Project Organization - Responsibilities

- Black & Veatch Subcontractors
 - Geomatrix Consultants - Provides analysis support for geological and seismological investigations, PSHA, SSE
 - Boart Longyear – Executes drilling and installation of piezometers and monitoring wells
 - Professional Service Industries – Executes laboratory testing, groundwater and surface water sampling
 - GeoVision – Executes P-S Suspension logging, downhole seismic testing, and SASW surface geophysics
 - ARM Geophysics – Executes downhole geophysics, consisting of televiwer, natural gamma logging, heat pulse logging, and caliper logging

Site Investigations Overview

Ed Meyer
Geotechnical Engineer
(Black & Veatch)

Investigation Objectives

Hydrogeology

- Refine the site and regional hydrogeologic characterization for COL application.
- Assess the potential for groundwater flow reversal.
- Assess the impact of accidental release of Fermi 3 liquid effluents.

Investigation Scope

Hydrogeology

- Perform hydrogeologic exploration program to confirm and refine characterization of the site aquifers using the following:
 - Installation of piezometers and monitoring wells.
 - Measurement of monthly site groundwater levels.
 - In situ testing to measure hydraulic properties.
 - Testing groundwater and surface water quality.
 - Laboratory testing.
- Prepare site groundwater flow contour maps.
- Evaluate potential for groundwater flow reversal.
- Evaluate impact of accidental release of Fermi 3 liquid effluents.

Investigation Objectives

Geotechnical

- Obtain subsurface information to define the following:
 - Site stratigraphy and groundwater conditions.
 - Static and dynamic soil and bedrock engineering properties.
 - Site geo-hazards and foundation conditions.
- Obtain data in areas supporting safety-related foundations to meet:
 - Regulatory Guide 1.132.
 - Vendor DCD and Soil Structure Interaction requirements.
- Collect data in non-safety related foundation areas.
- Obtain additional site groundwater characterization for dewatering evaluation.

Investigation Scope

- Perform a geotechnical exploration program using the following:
 - Drilling borings.
 - Performing soil and bedrock laboratory testing.
 - Performing in situ downhole and surface geophysical testing.
 - Measuring groundwater levels in piezometers.
- Evaluate variability of site conditions, and soil/bedrock parameters.
- Evaluate site suitability with respect to regulatory guidance and reactor vendor DCD.
- Evaluate Fermi 3 shear wave velocity profile, site response, and design earthquake parameters.



Regional Geology Overview

Kathryn Hanson
Principle Geologist
(Geomatrix Consultants)

Objectives of Geological, Geophysical, & Seismological Investigations

- Identification and Characterization of Seismic Sources
 - Seismogenic sources and capable tectonic sources- significant to the site seismic hazard
 - Focus on new information that post-dates the EPRI-SOG study in the mid-to late 1980s
- Evaluation of the potential for surface faulting at the site
 - Tectonic and non-tectonic deformation

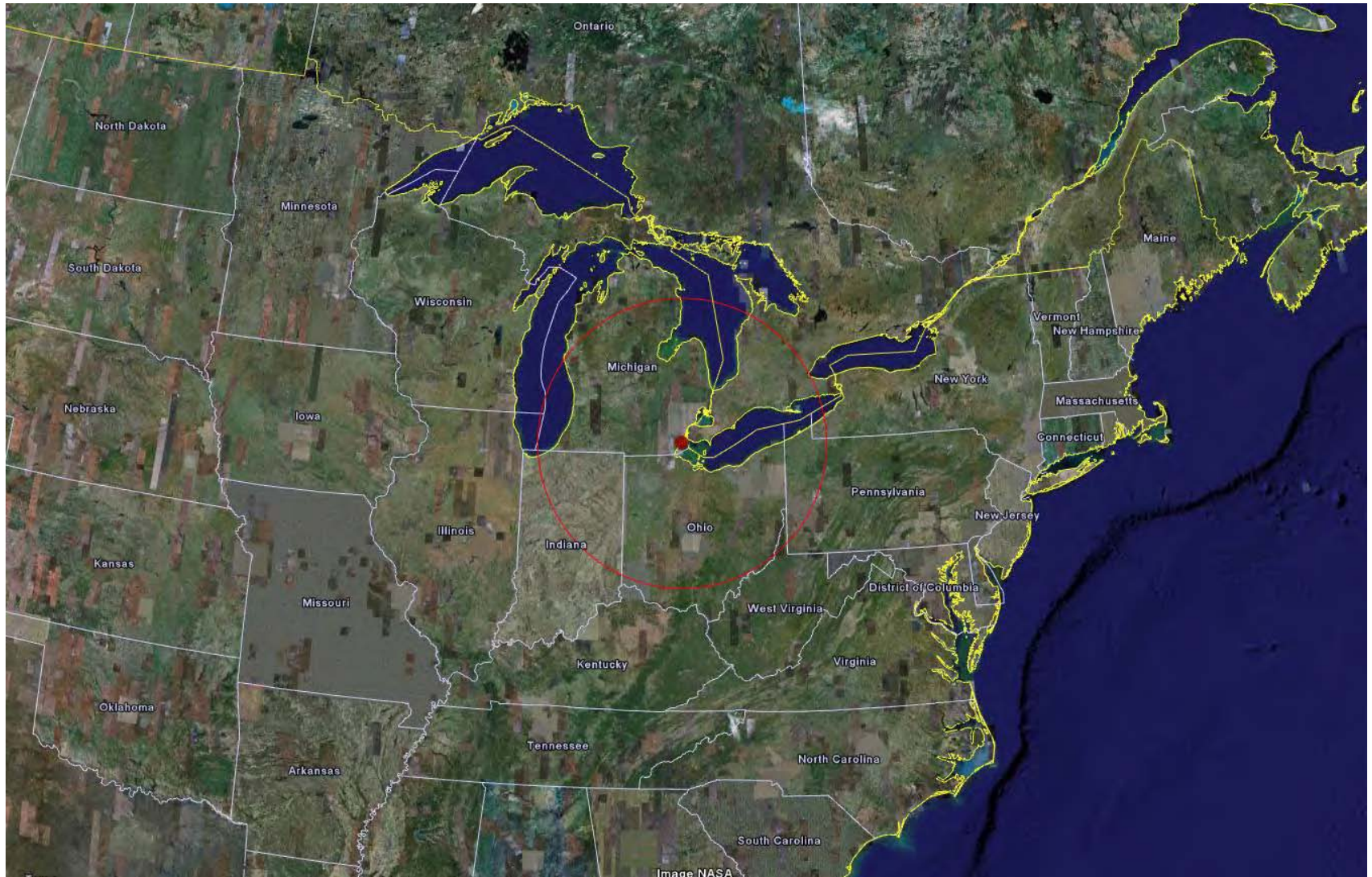
Investigations to Evaluate Seismic Sources

- **Compilation and Review of Available and New Data**
 - Seismicity –update earthquake catalog
 - Geological and Geophysical Data
 - Remote Sensing imagery (satellite; DEM, LiDAR)
 - Interpretation of aerial photography (Site Area)
 - Field Investigations
 - Mapping of topographic, geologic, geomorphic, and hydrologic features
 - Analysis of Quaternary sedimentary deposits and soils
 - Geotechnical

Levels of Investigation

- **RG 1.165 and RG 1.208** describe the regions around a proposed site for a nuclear facility and the level of investigation needed to confirm the suitability of the site. The guidance outlines four levels of investigation that generally increase in detail with proximity to the site
 - Site Region 320-km (200-mi.) radius
 - Site Vicinity 40-km (25-mi.) radius
 - Site Area 8-km (5-mi.) radius
 - Site Location 1-km (0.6-mi.) radius

Site Region [320-km (200-mi) Radius from site]



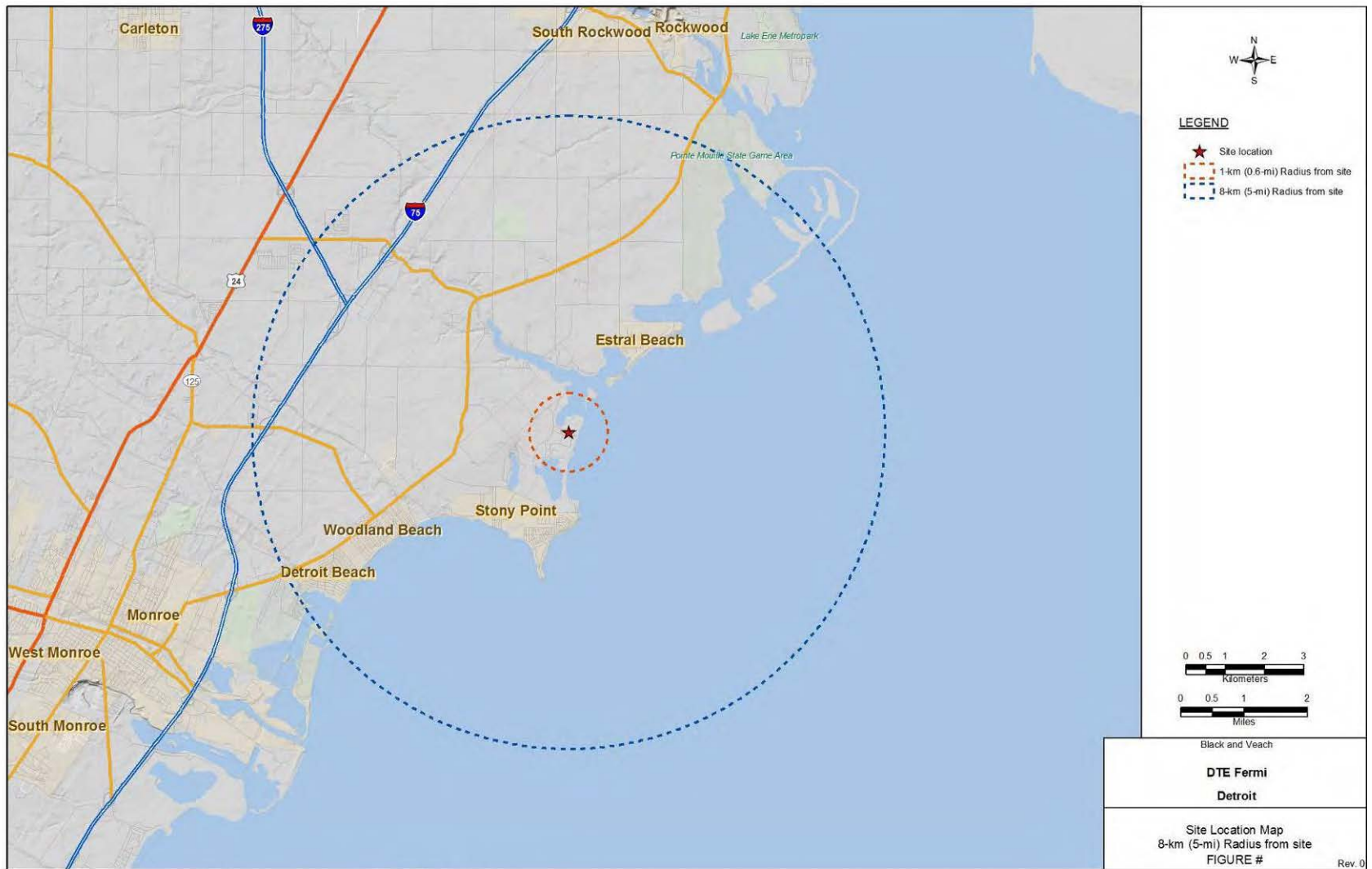
Site Region [320-km (200-mi) Radius from site]



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Date: [06/07/2007]: User: sbozkurt

Site Area [8-km (5-mi) Radius from site]



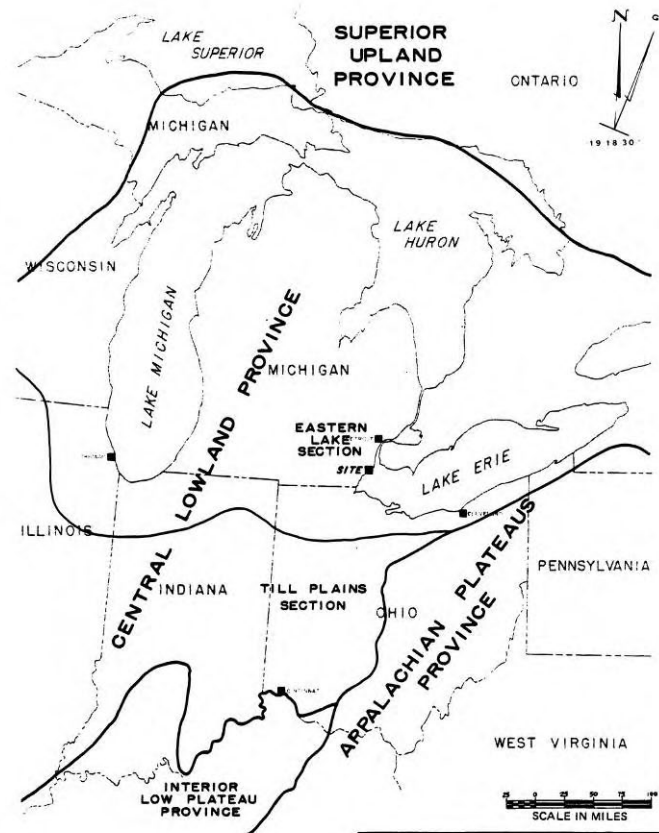
Site Location [1-km (0.6-mi) Radius from site]



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Date: [06/07/2007]: User: sbzskurt

Regional Physiographic Map



REFERENCE:
MODIFIED FROM FENNEMAN, N. 1946; PHYSICAL
DIVISIONS OF THE UNITED STATES IN COOPERATION
WITH THE PHYSIOGRAPHIC COMMITTEE OF THE U. S.
GEOLOGICAL SURVEY.

MODIFIED FROM: BASEMENT ROCK MAP OF THE
UNITED STATES, COMPILED BY RICHARD W. BAYLEY,
UNITED STATES GEOLOGICAL SURVEY, AND WILLIAM
MUEHLBERGER, UNIVERSITY OF TEXAS, 1968.

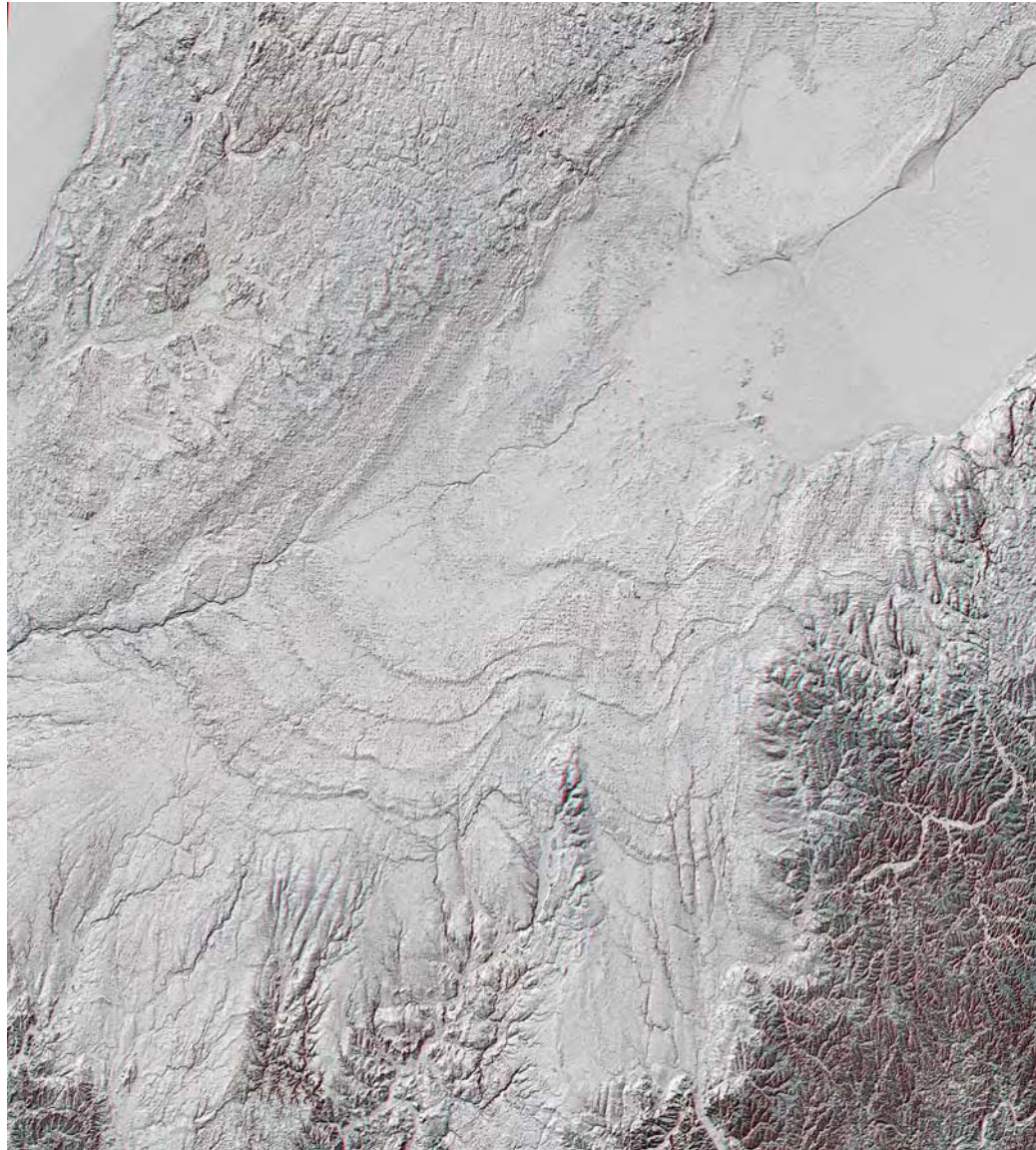
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FIGURE 2.5-1
CENTRAL LOWLAND PROVINCE
REGIONAL PHYSIOGRAPHIC MAP

Regional Surface Geology Map



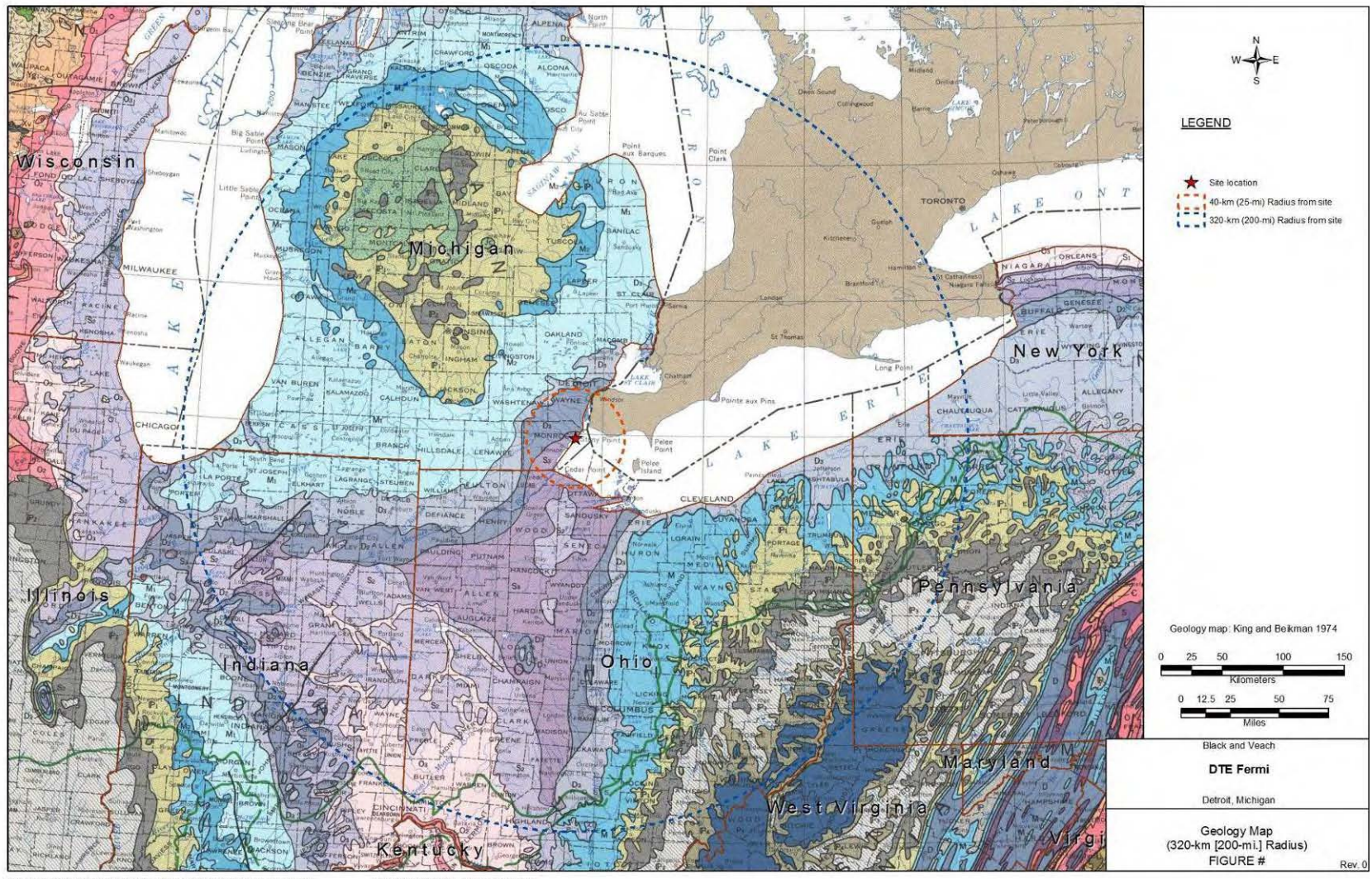
Regional DEM Map



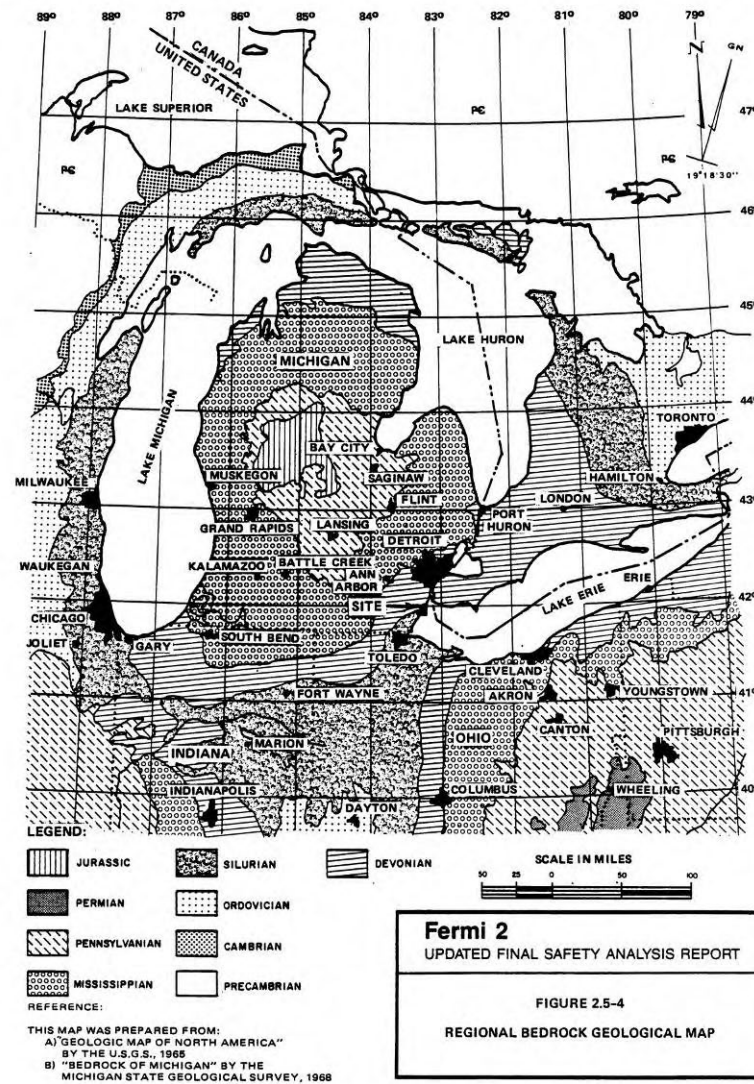
Regional DEM Map



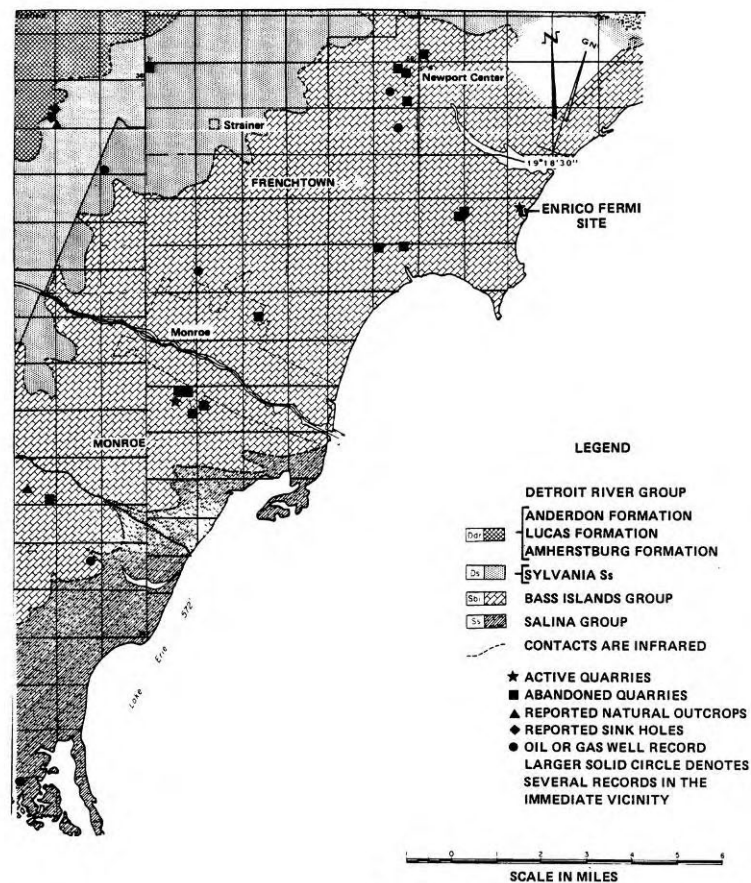
Regional Geologic Map (320-km [200-mi] Radius)



Regional Bedrock Geology Map



Area Bedrock Geology Map

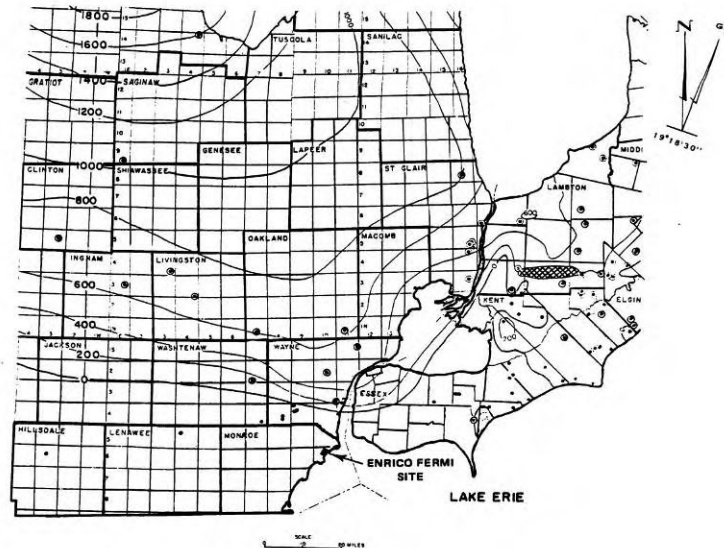


REFERENCE:
MAZOLA, A. J., 1969, BEDROCK GEOLOGIC MAP OF MONROE COUNTY, MICHIGAN: FROM REPORT OF INVESTIGATION 13, GEOLOGY FOR ENVIRONMENTAL PLANNING IN MONROE COUNTY, MICHIGAN; GEOLOGICAL SURVEY DIVISION, DEPARTMENT OF NATURAL RESOURCES, 1970.

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FIGURE 2.5-5
AREA BEDROCK GEOLOGICAL MAP

Isopach Map of Thickness of Salt in Salina Formation



LEGEND:
ISOPACH SHOWING TOTAL THICKNESS
OF SALT. ISOPACH INTERVAL 200 FEET.

- WELL REPORTING SALT IN SALINA FORMATION
- WELL WITH NO SALT IN SALINA FORMATION
- DAWN GAS FIELD, SALT 0 TO OVER 300 FEET THICK

0 10 20
SCALE IN MILES

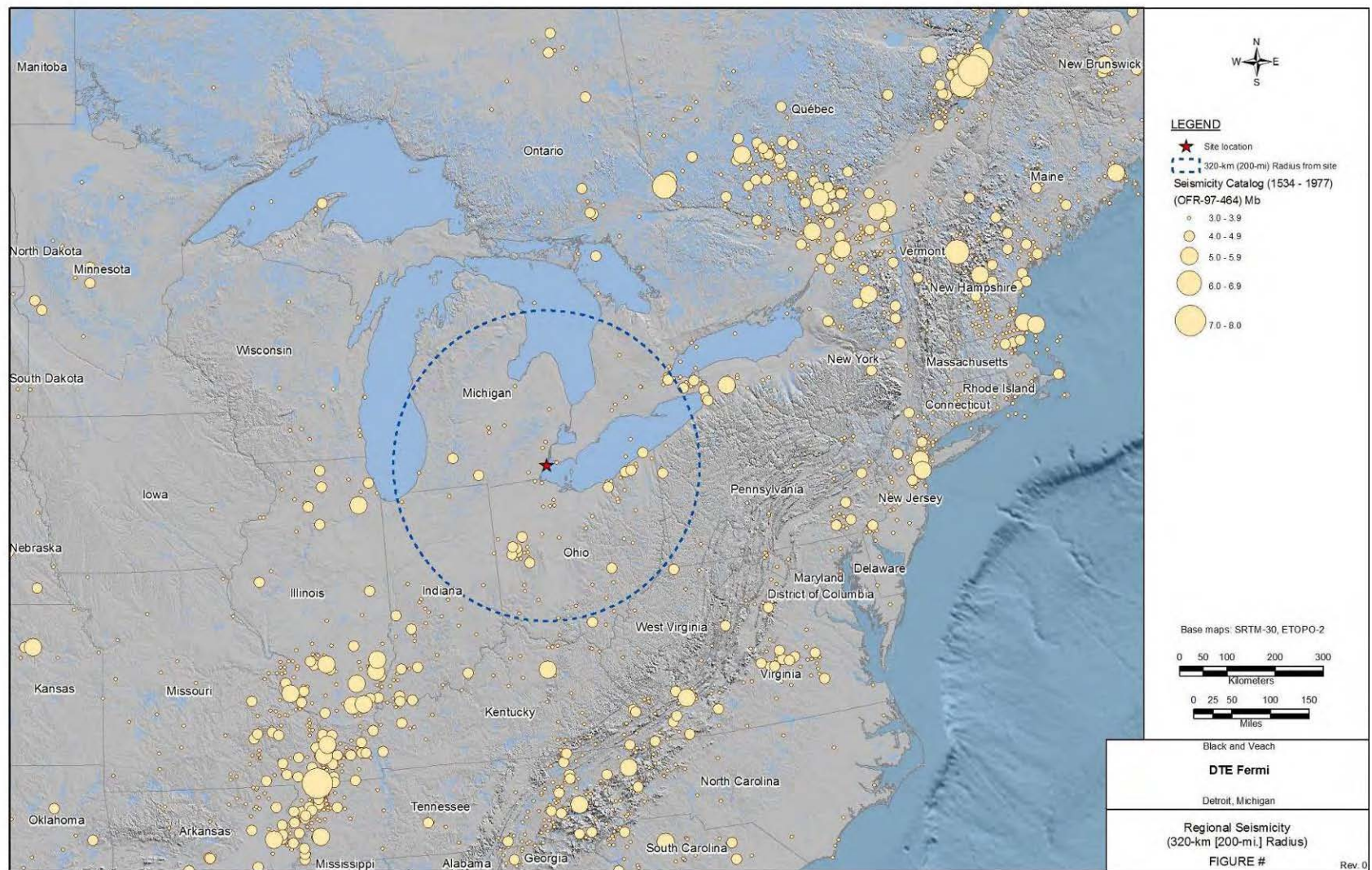
REFERENCE:
LANDES, K. K., 1945, THE SALINA AND BASS
ISLANDS ROCK IN THE MICHIGAN BASIN:
USGS., PRELIMINARY DM-40, OIL AND GAS
INV. SER.

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FIGURE 2.5-21

ISOPACH MAP - TOTAL THICKNESS OF SALT IN
SALINA FORMATION IN SOUTHEASTERN
MICHIGAN

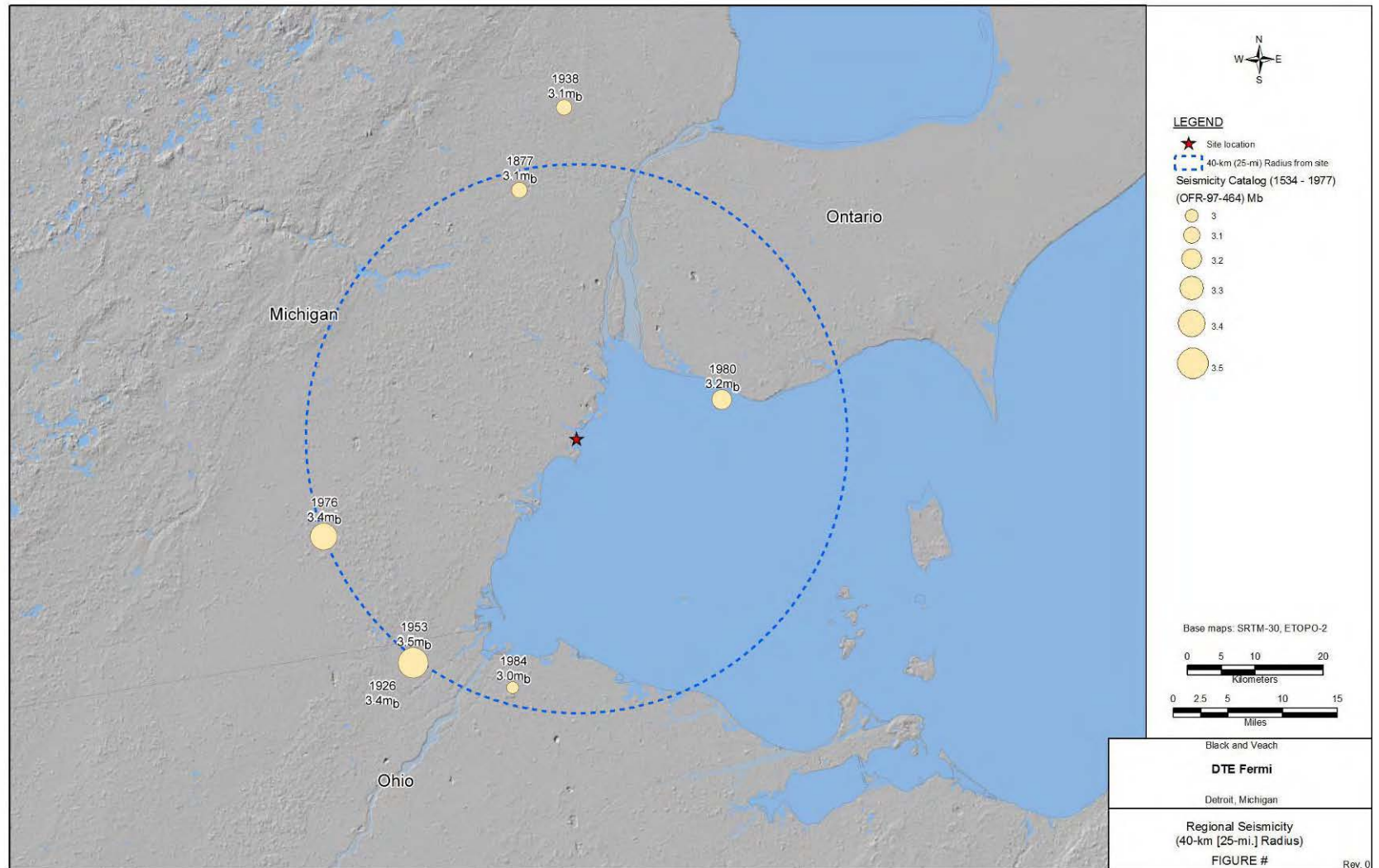
Regional Seismicity (320 km [200 mi.])



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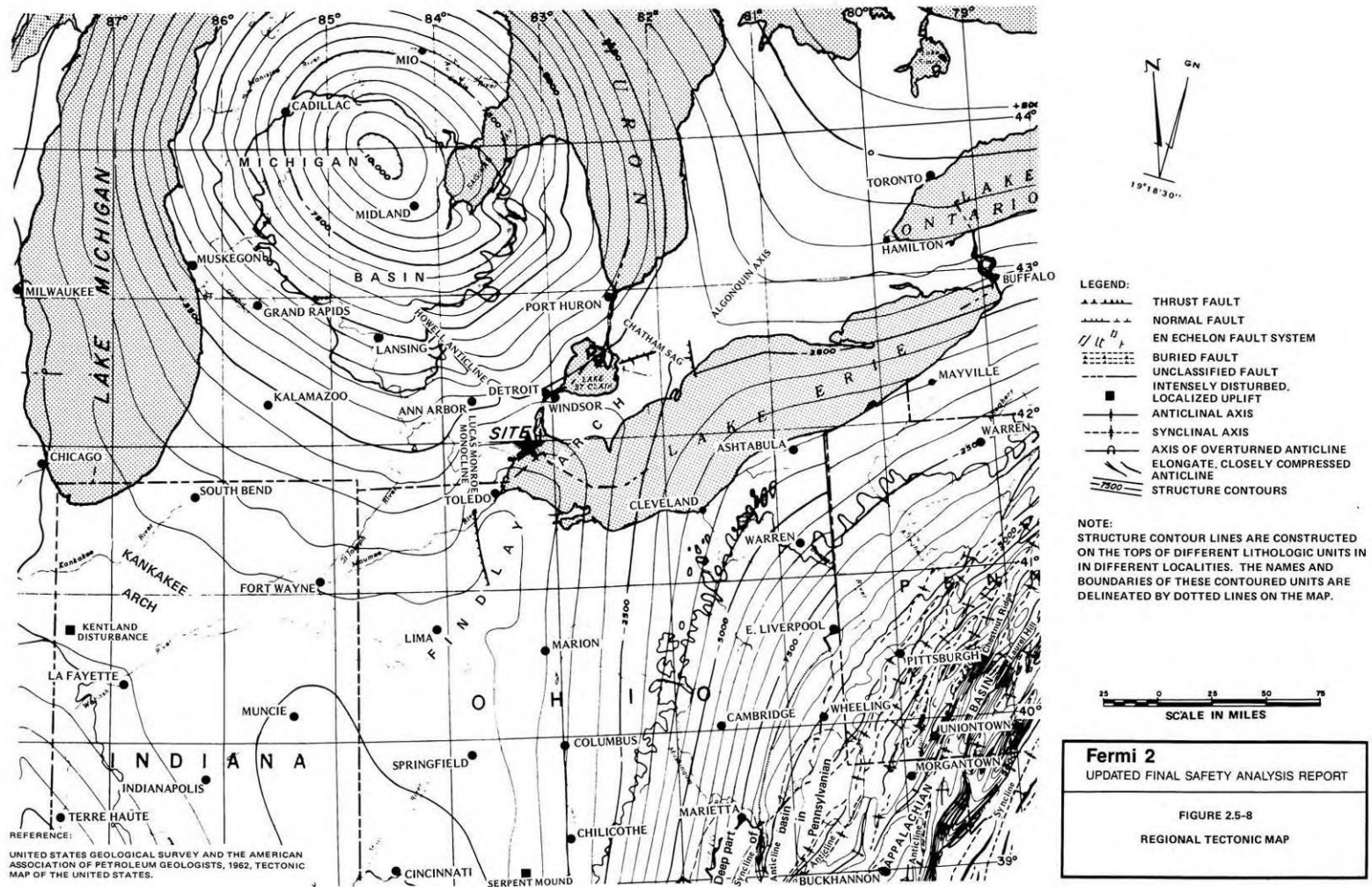
Site Vicinity Seismicity (40 km [25 mi.])



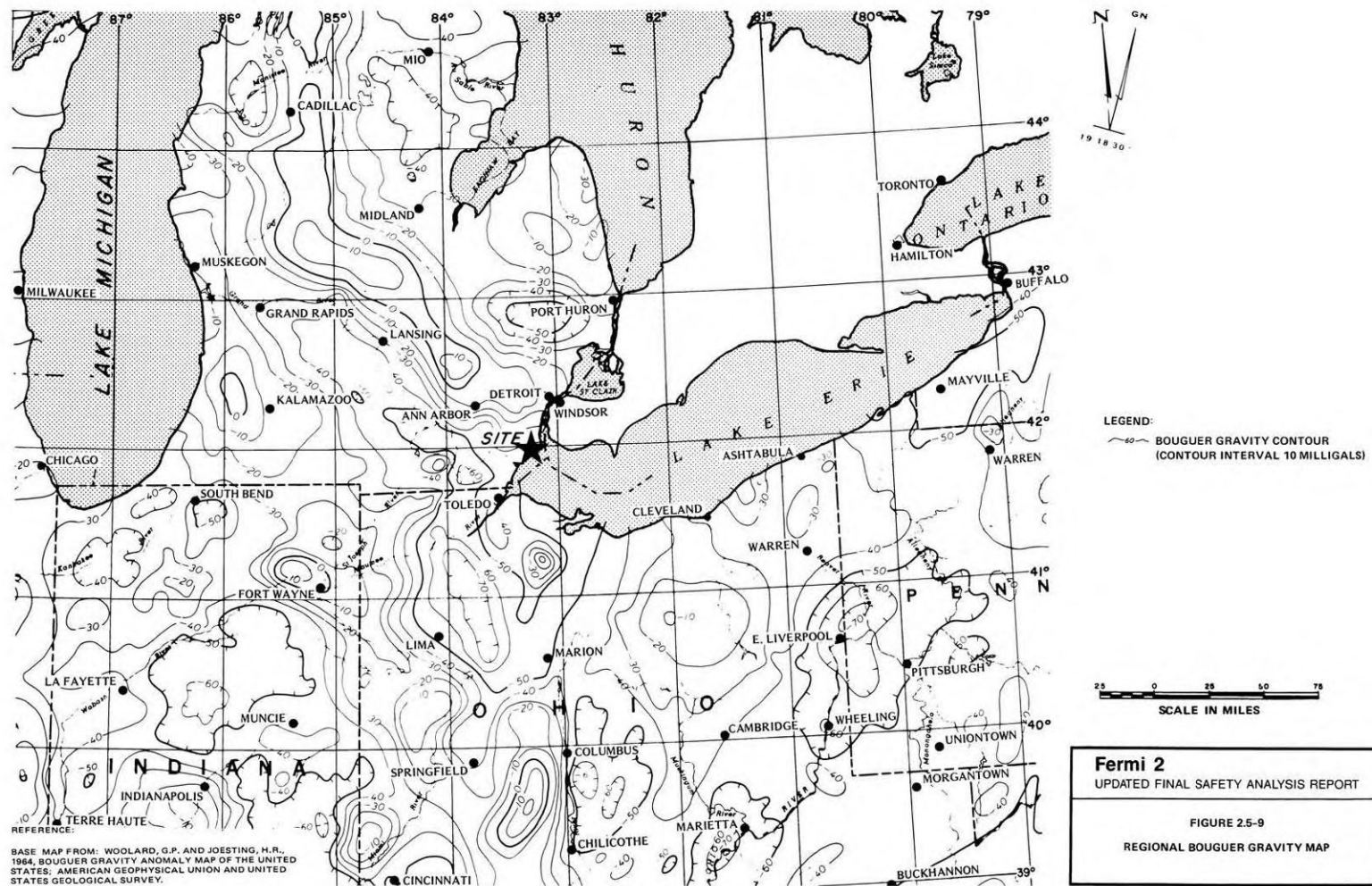
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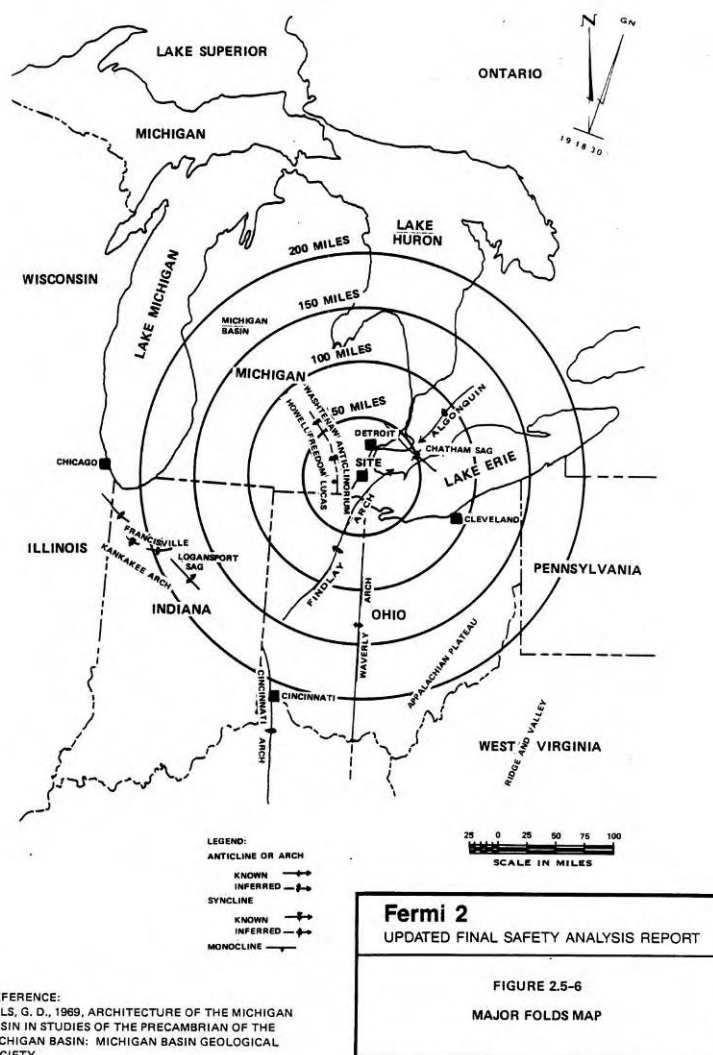
Regional Tectonic Map



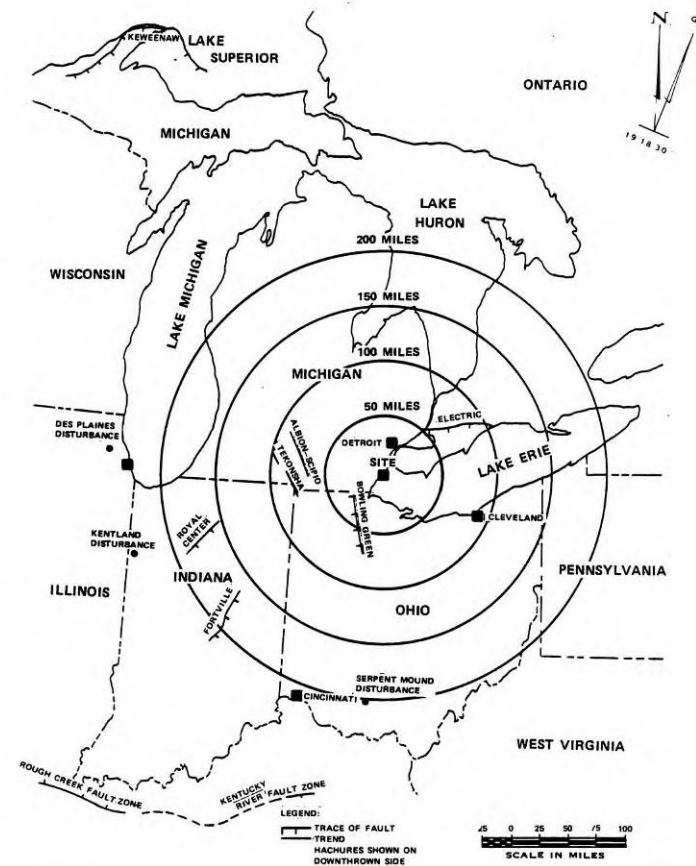
Regional Bouguer Gravity Map



Regional Major Folds Map



Regional Major Faults Map



REFERENCE:
BRIGHAM, R. J., 1972, STRUCTURAL GEOLOGY OF SOUTHWESTERN ONTARIO AND SOUTHEASTERN MICHIGAN, ONTARIO MINES AND NORTHERN AFFAIRS AFFAIRS, PETROLEUM RESOURCES SECTION PAPER 71-2.
BRISTOL, H. M., AND T. C. BUSHBACH, 1971, STRUCTURAL FEATURES OF THE EASTERN INTERIOR REGION OF THE UNITED STATES IN ILLINOIS GEOLOGICAL SURVEY, ILLINOIS PETROLEUM PUB 96.

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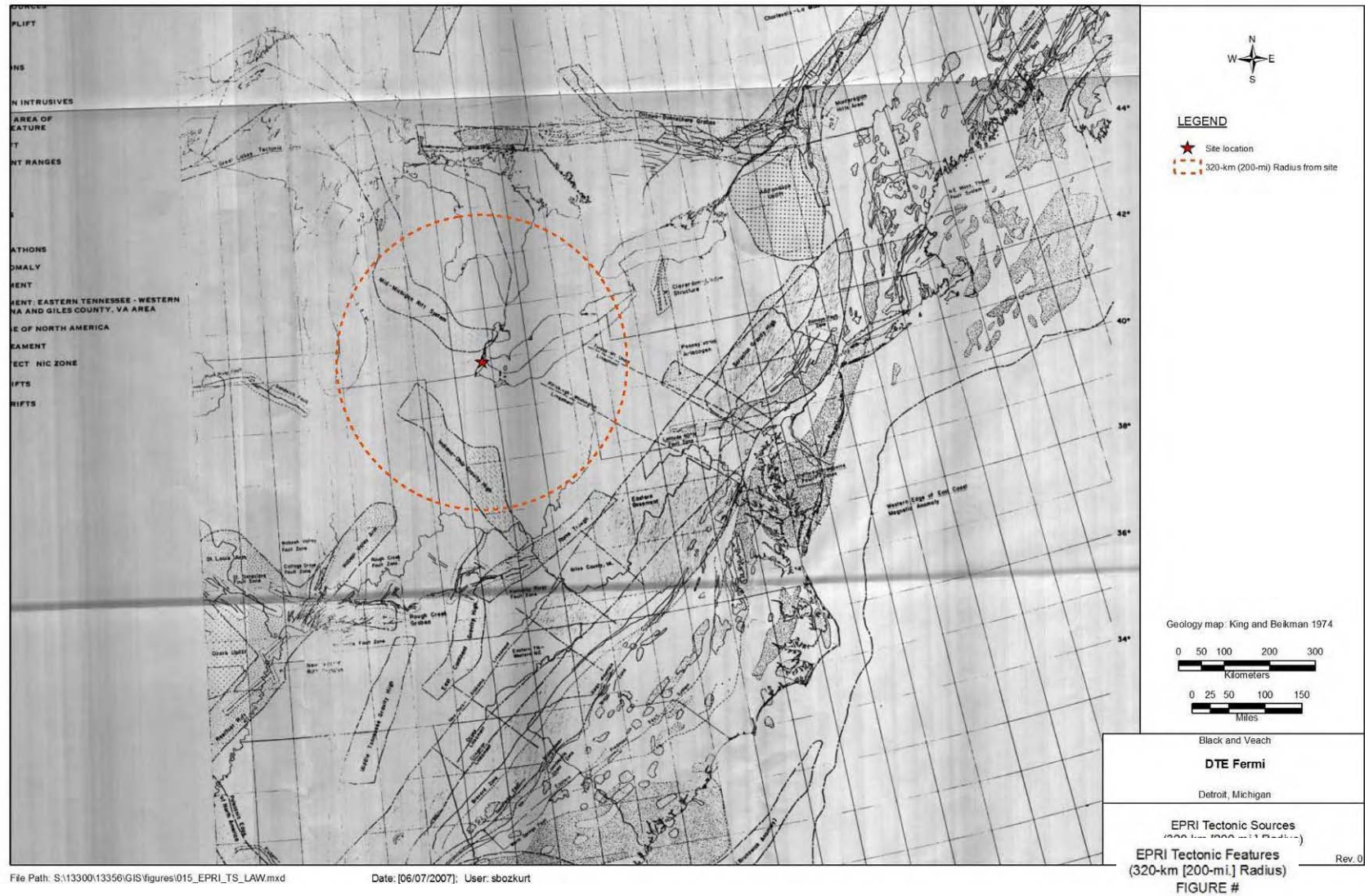
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FIGURE 2.5-7
MAJOR FAULTS MAP

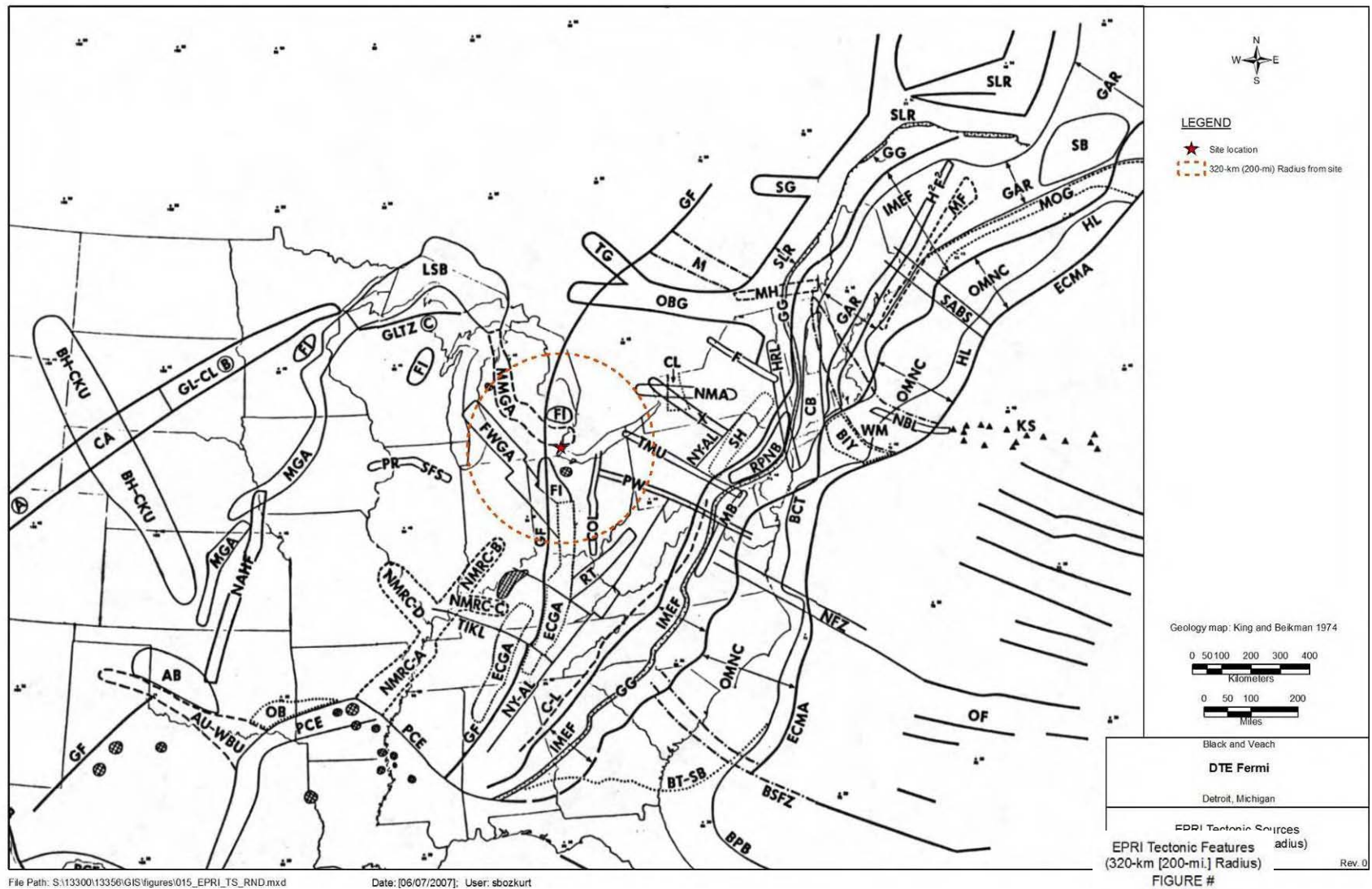
Faults and Potential Seismic Sources (UFSAR)

- No faults / tectonic structures within 25 mi
- No pop-ups in region
- Howell Anticline (25 mi N)
- Bowling Green Fault (25 mi SW)
- Electric Fault [Chatham Sag (50 mi NE)]
- Tekonsha and Albion-Scipio Trends (within 100 mi)
- Rough Creek-Kentucky River Fault System (350 mi S)
- Keweenawan-Lake Owen Fault System (430 mi)
- New Madrid (Reelfoot) Fault / Seismic Zone (500 mi SW)

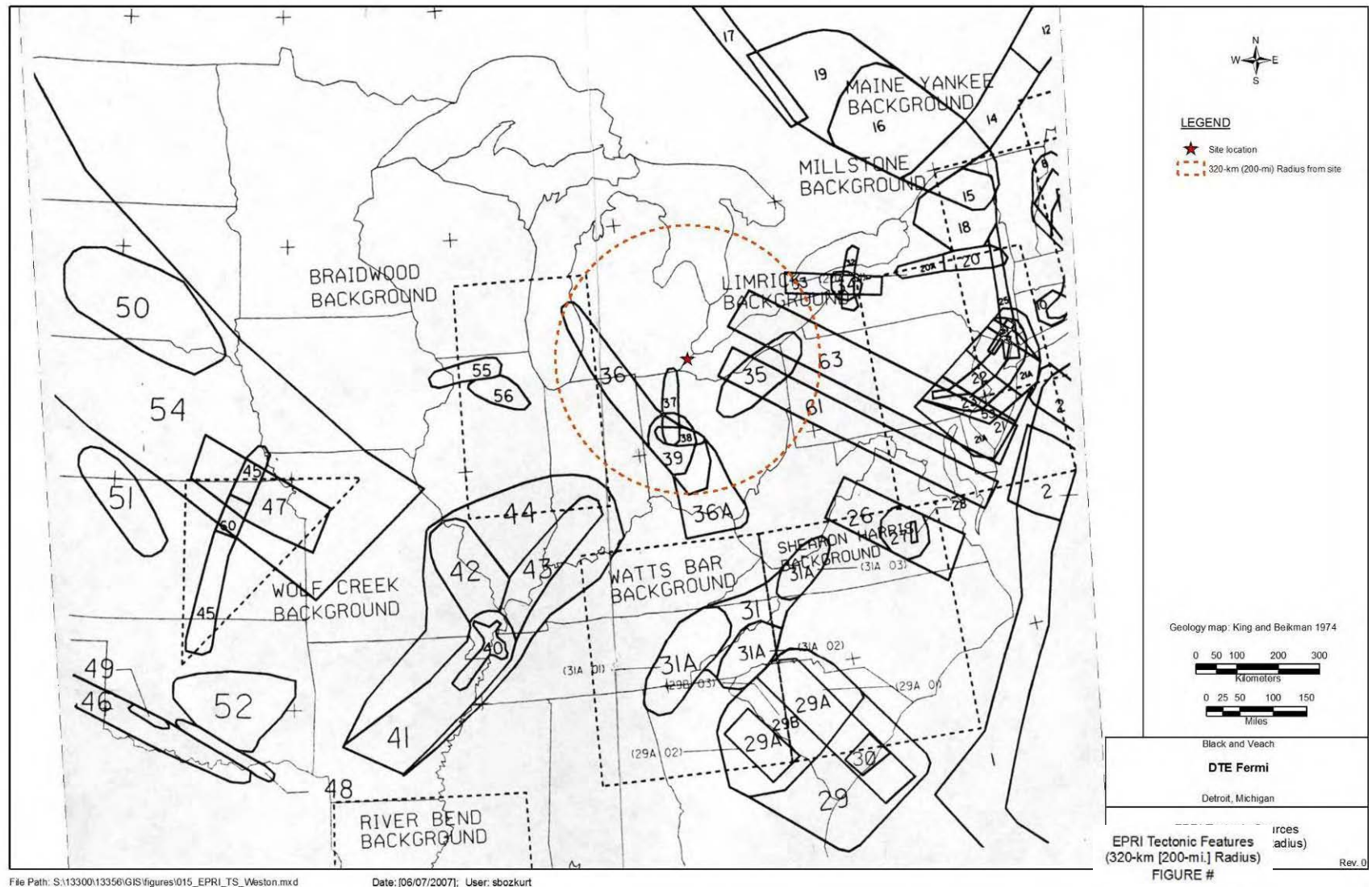
EPRI Tectonic Features - LAW Team



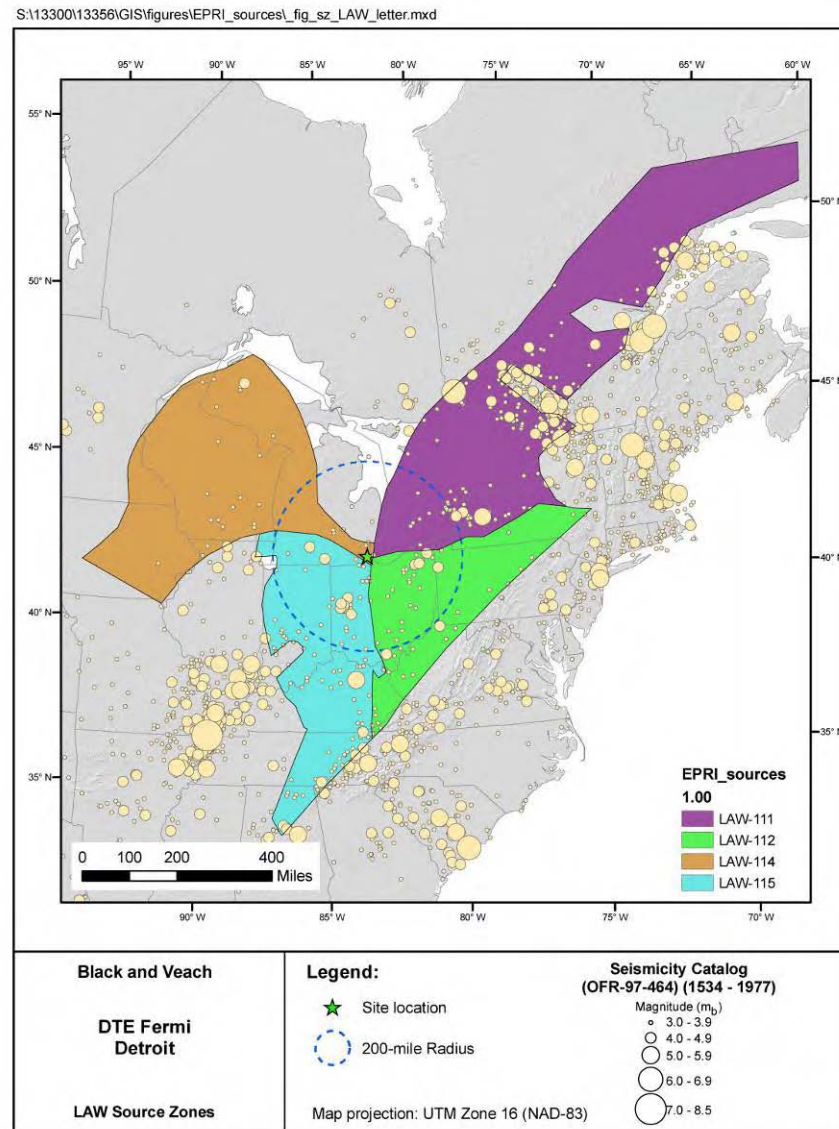
EPRI Tectonic Features - RND Team



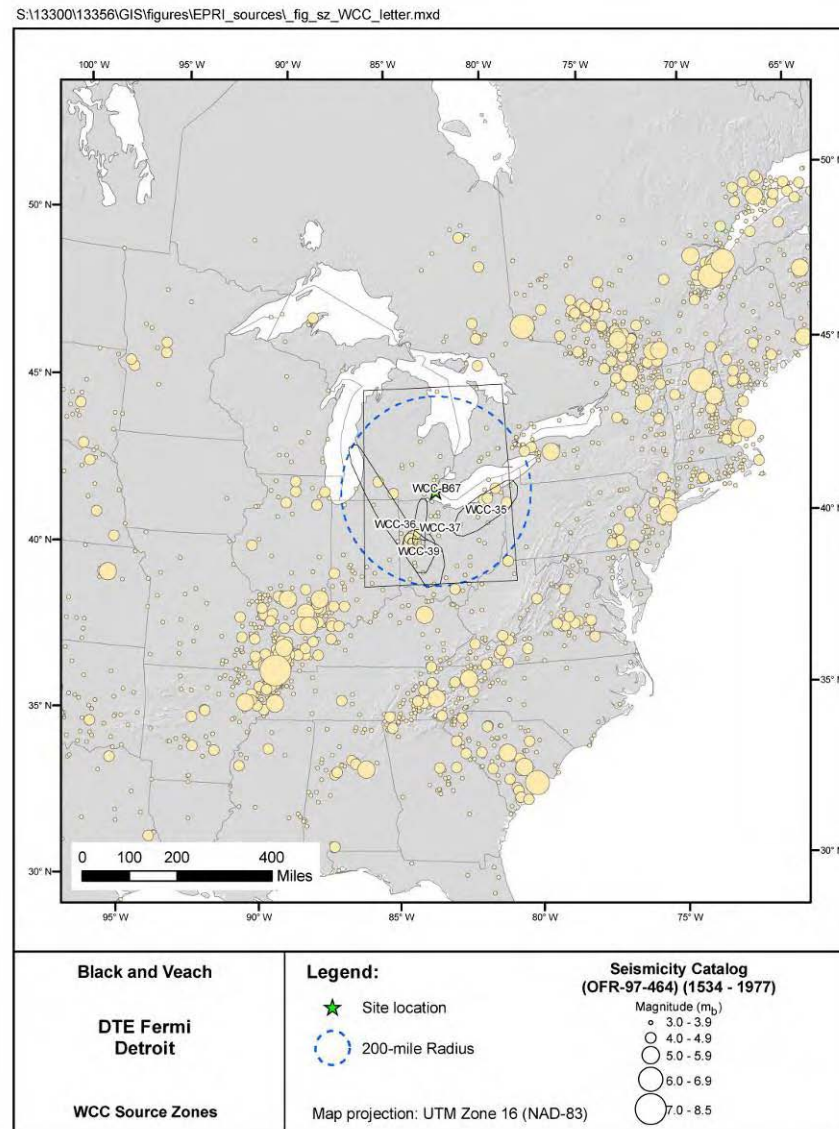
EPRI Tectonic Features - WCC Team



EPRI-SOG Seismic Source Map – Law Team

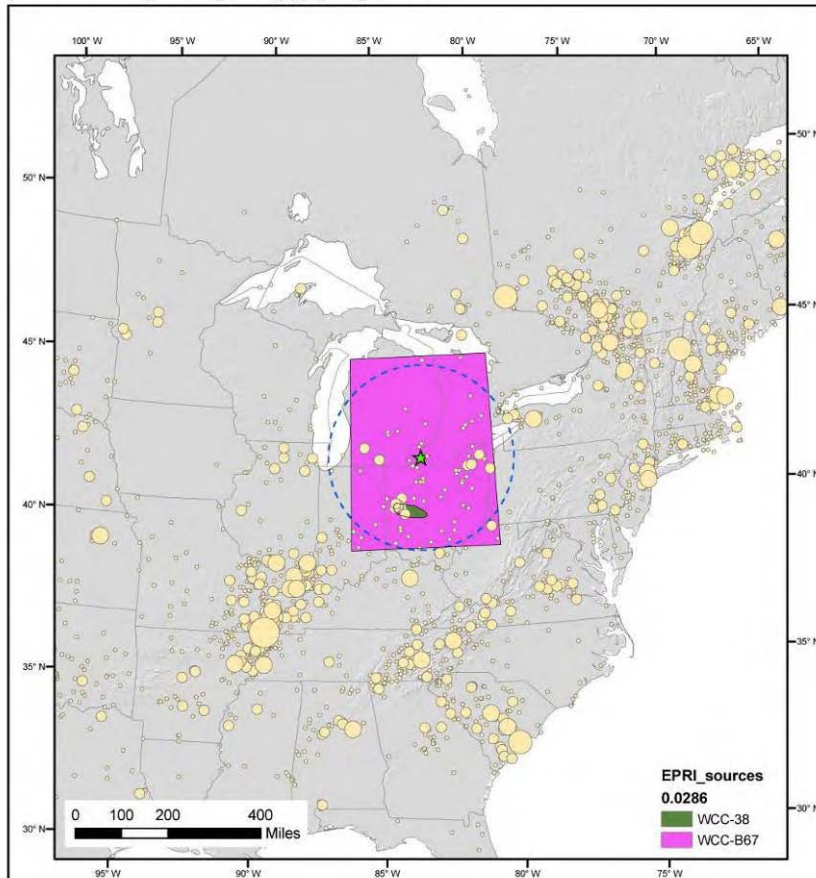


EPRI-SOG Seismic Source Map – WCC Team



EPRI-SOG Seismic Source Map – WCC Team

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Black and Veatch

DTE Fermi
Detroit

WCC Source Zones

Legend:

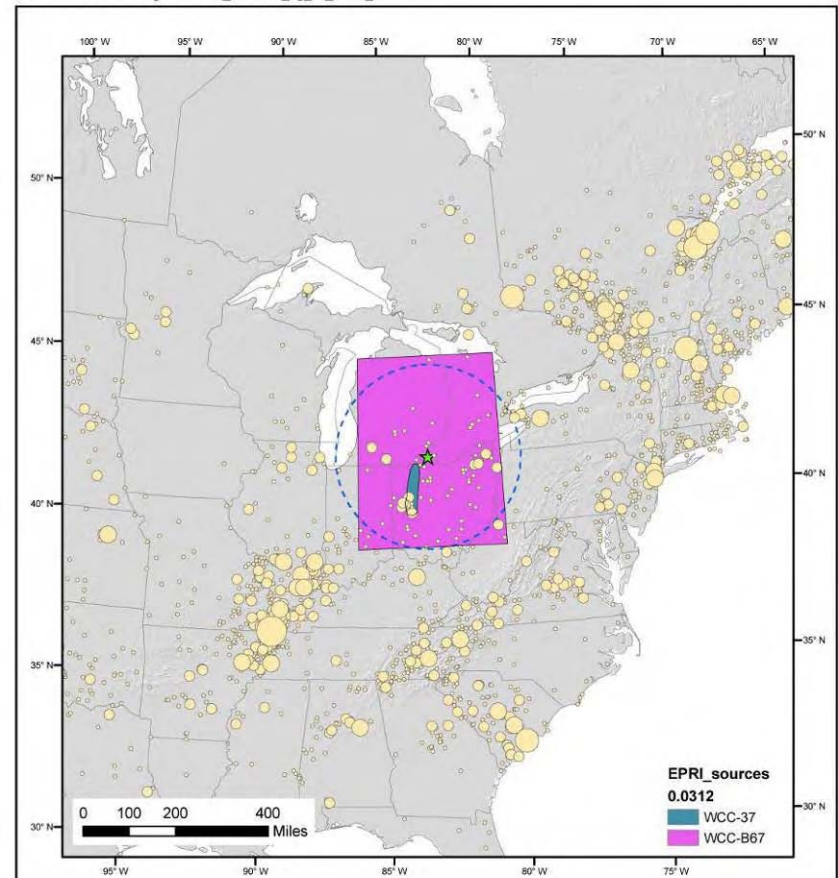
- ★ Site location
- 200-mile Radius

Map projection: UTM Zone 16 (NAD-83)

**Seismicity Catalog
(OFR-97-464) (1534 - 1977)**

- Magnitude (m_b)
- 3.0 - 3.9
 - 4.0 - 4.9
 - 5.0 - 5.9
 - 6.0 - 6.9
 - 7.0 - 8.5

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Black and Veatch

DTE Fermi
Detroit

WCC Source Zones

Legend:

- ★ Site location
- 200-mile Radius

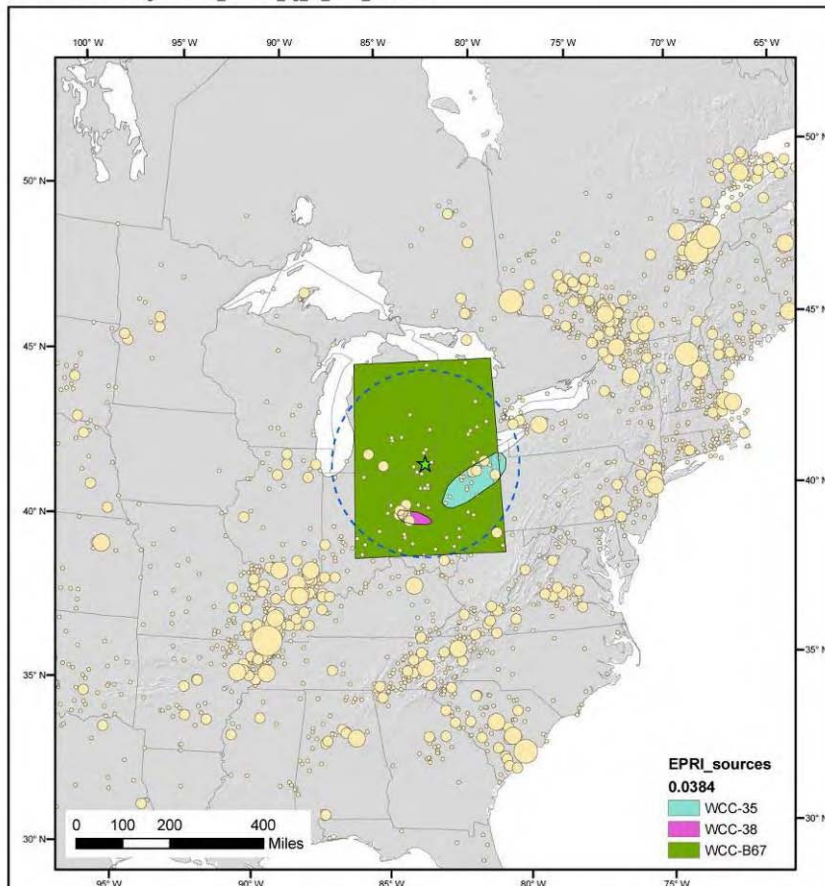
Map projection: UTM Zone 16 (NAD-83)

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EPRI-SOG Seismic Source Map – WCC Team

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Black and Veatch

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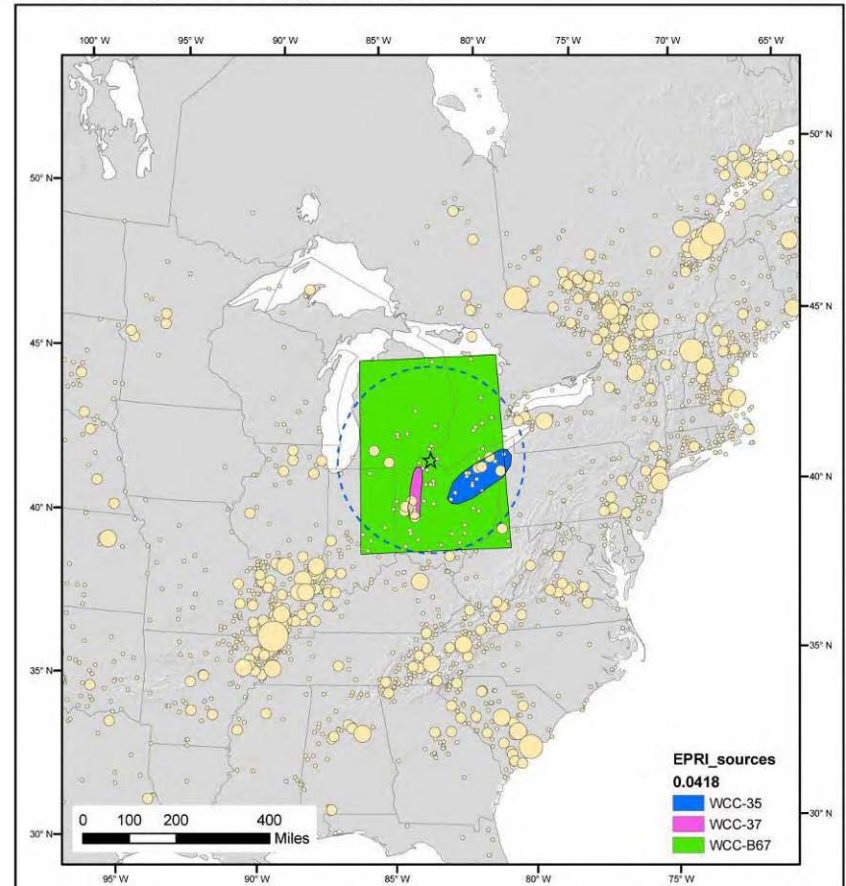
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Black and Veatch

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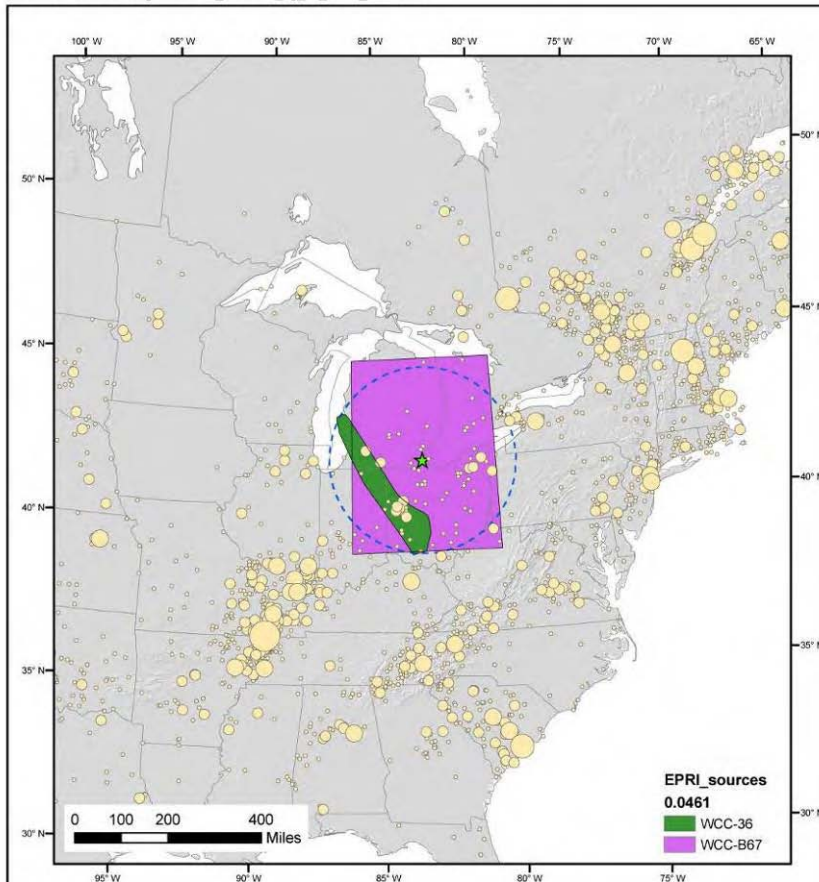
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EPRI-SOG Seismic Source Map – WCC Team

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Black and Veatch

DTE Fermi
Detroit

WCC Source Zones

Legend:

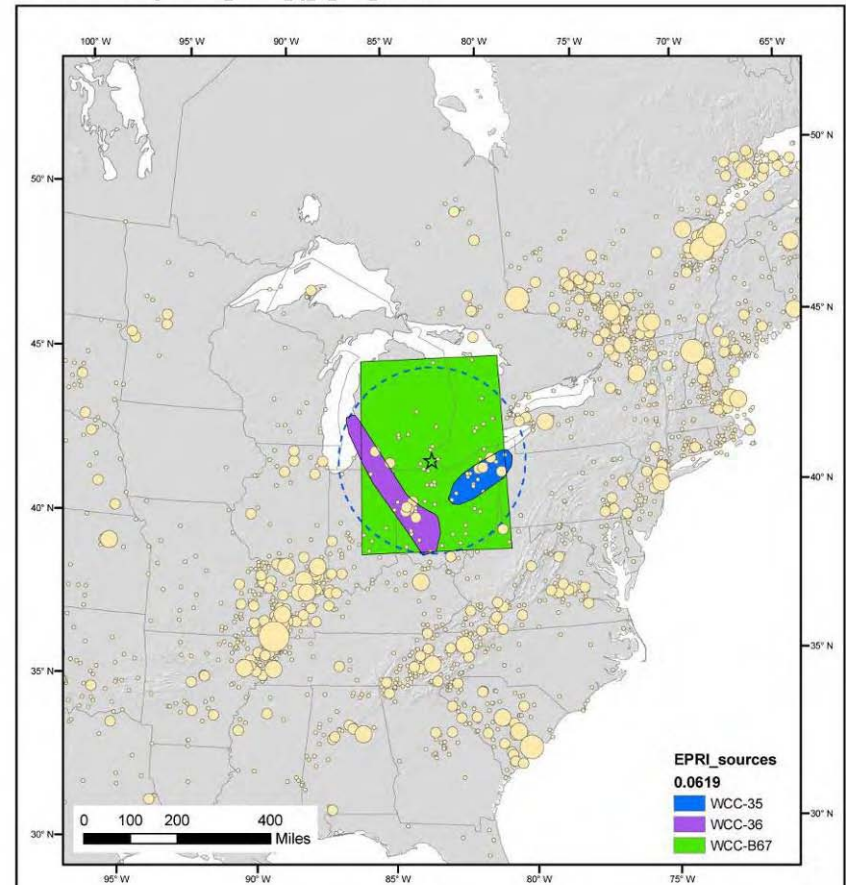
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Black and Veatch

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Detroit

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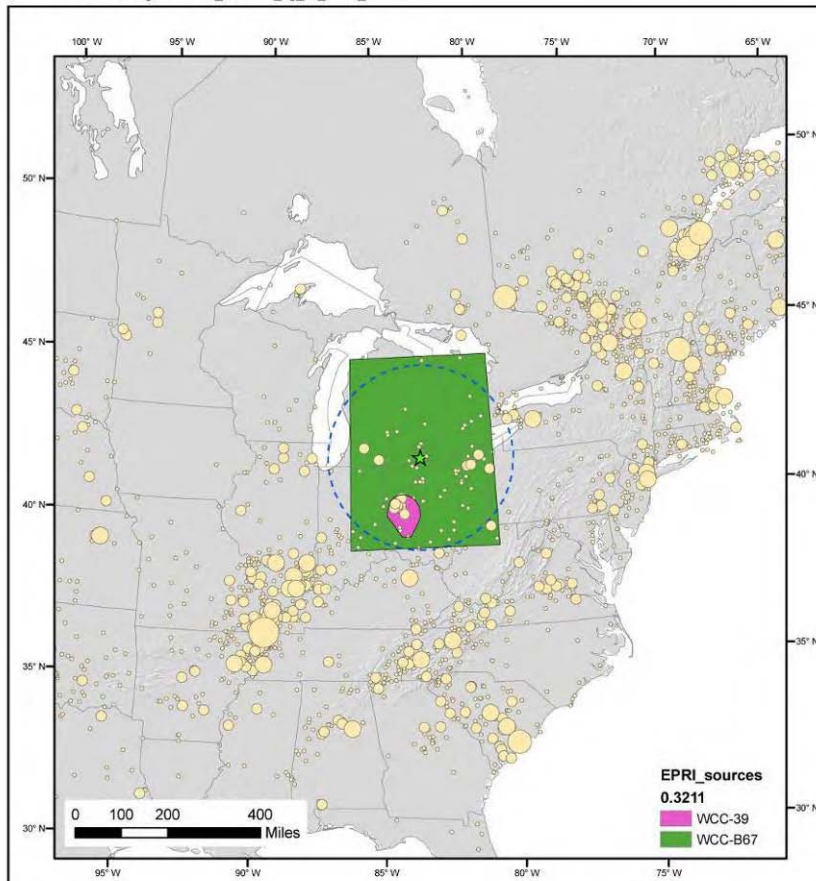
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EPRI-SOG Seismic Source Map – WCC Team

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Black and Veatch

DTE Fermi
Detroit

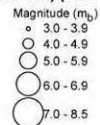
WCC Source Zones

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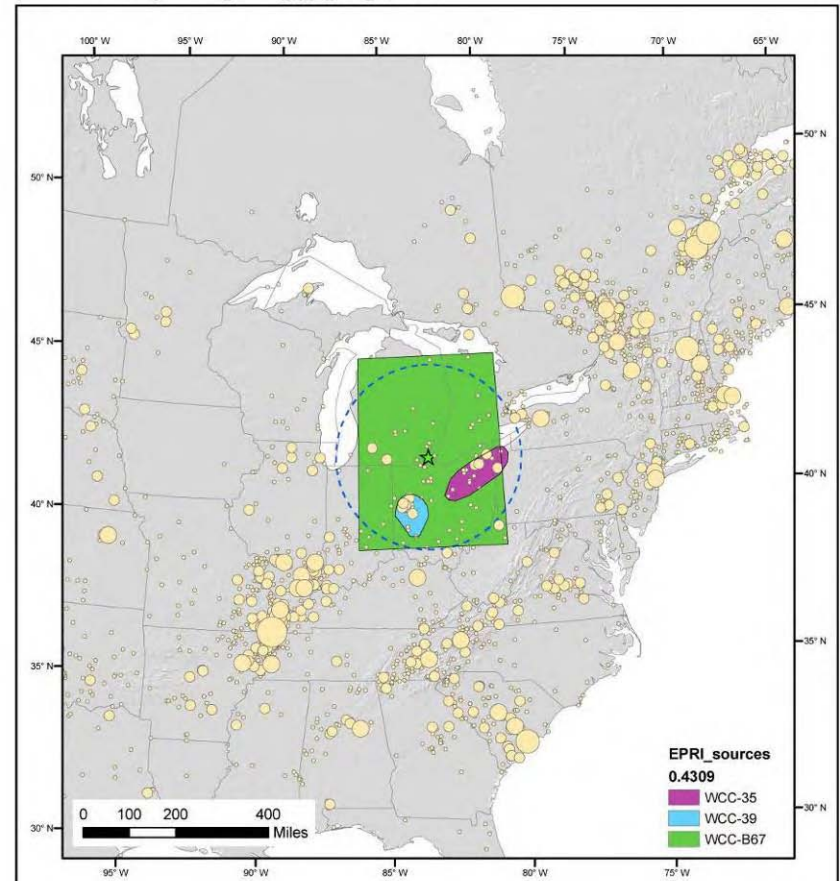
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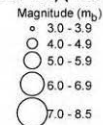
WCC Source Zones

Legend:

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Map projection: UTM Zone 16 (NAD-83)

Seismicity Catalog
(OFR-97-464) (1534 - 1977)



PSHA –Steps to Update

- Evaluation of new information that would indicate new source zones or modifications to the geometry, recurrence, or maximum magnitude of EPRI-SOG sources
- Incorporate new ground motion models (EPRI, 2004, 2006)
- Sensitivity Analyses:
 - Identify the complete EPRI-SOG source set based on new attenuation models (99 percent of total hazard)
 - Wabash Valley Source Zone- updated Mmax
 - NMSZ- Clustered events; ~500 yr repeat time; real-time occurrence probabilities
 - Updates to source location, recurrence, or Mmax for other sources as needed



Site Geology Overview

Gregory Ohlmacher
Senior Geologist
(Black & Veatch)

Site Stratigraphic Column

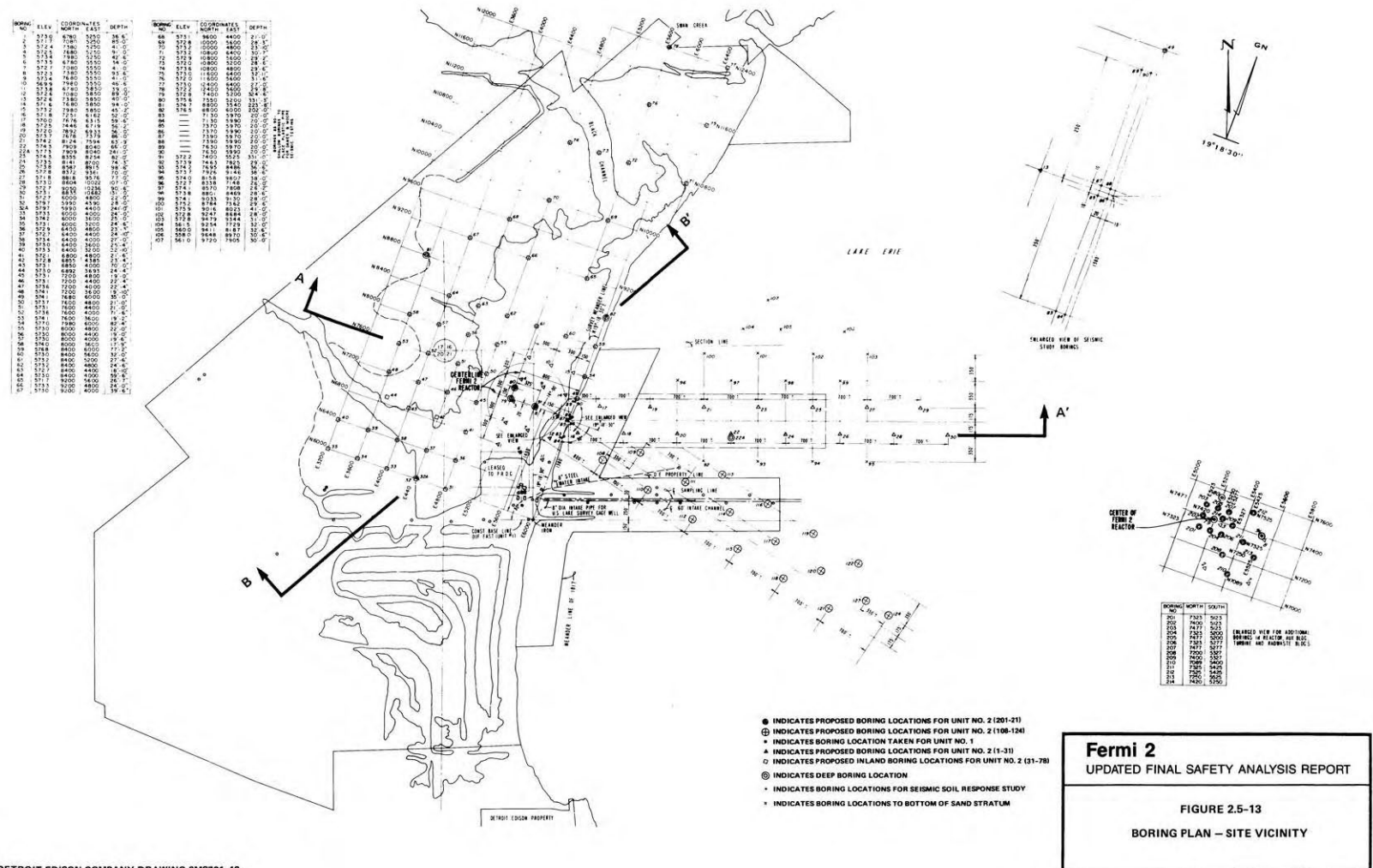
SYSTEM	STRATIGRAPHIC NOMENCLATURE	GRAPHIC LOG	AVERAGE THICKNESS (FEET)	LITHOLOGY
QUAT.	Recent and Pleistocene		15-30	Lake Deposits and Glacial Till
SILURIAN	Bass Islands Group		80	Dolomite
	Salina Group		525	Shales and Shaly Dolomite Shaly Dolomite Limestone and Dolomite Breccias Dolomite and Shaly Dolomite Limestone and Dolomite
	Niagara Group		425	Dolomite
	Cataract Group		100	Shale and Dolomite
	Richmond Group		625	Shale and Dolomite
ORDOVICIAN	Trenton - Black River Group		825-850	Dolomites and Shales
	St. Croixian Series		475	Sandstones (with some Dolomites)
PRE-CAMBRIAN				Granitic Gneiss

NOTE:
THICKNESS OF THE BASS ISLANDS GROUP AND PART OF THE SALINA GROUP BASED ON SITE EXPLORATORY BORINGS. OTHER THICKNESSES BASED ON MICHIGAN WELL LOGS, BRIGHAM, (1972) FISHER, (1969) AND ELLS, (ORAL COMMUNICATION)

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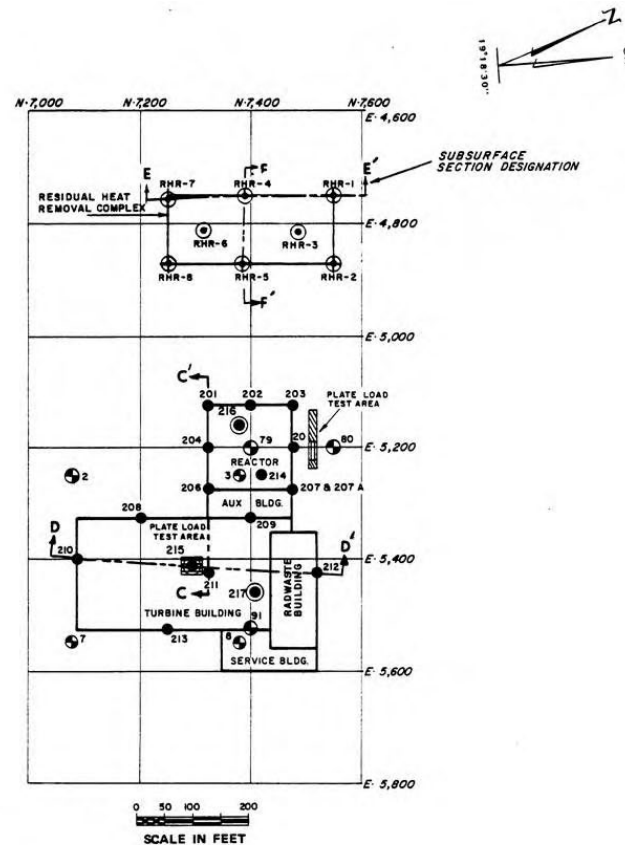
FIGURE 2.5-11
SITE STRATIGRAPHIC COLUMN

Site Vicinity/Fermi 2 Boring Plan



DETROIT EDISON COMPANY DRAWING 6MS721-40

Fermi 2 Boring Plan



KEY:

- ⊕ BORINGS DRILLED FOR P.S.A.R. (1968)
- BORINGS DRILLED FOR SUPPLEMENT TO P.S.A.R. (1969)
- ⊙ BORINGS DRILLED FOR SOIL AND ROCK STUDIES (1970)
- ⊗ BORINGS DRILLED FOR RHR COMPLEX FOUNDATION INVESTIGATION (1972)

SOURCE DRAWING REFERENCE:
REFERENCE 3, PLATE 2

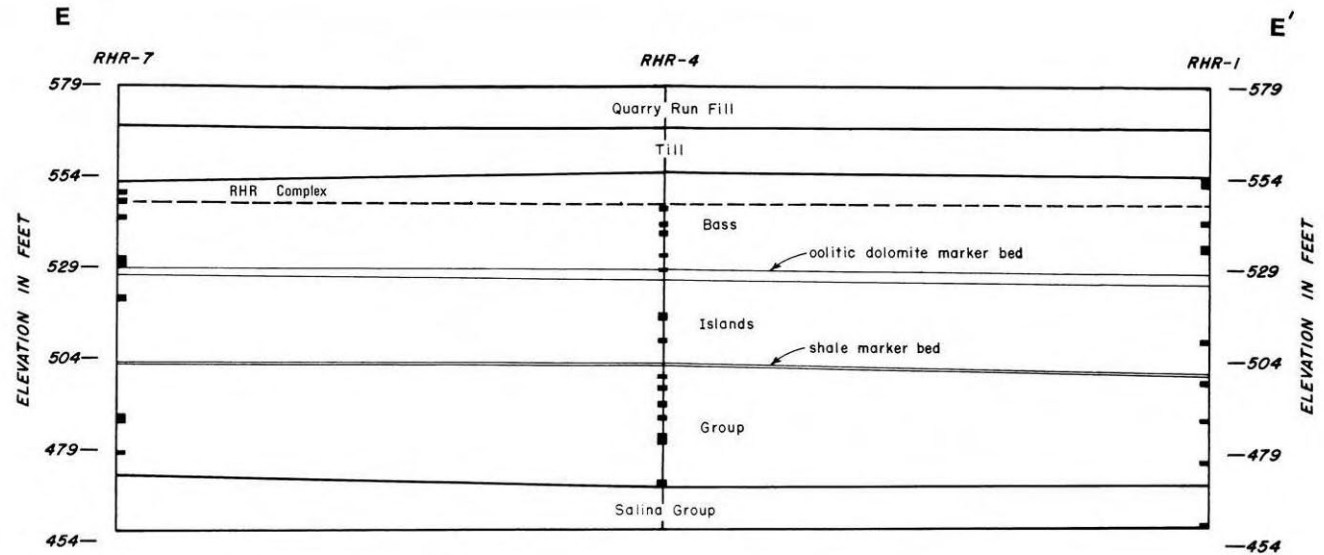
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FIGURE 2.5-14

BORING PLAN - REACTOR/AUXILIARY BUILDING,
RHR COMPLEX, TURBINE RADWASTE
BUILDING, AND SERVICE BUILDING

Fermi 2 Subsurface Section E-E'



NOTES:
ELEVATIONS REFER TO N.Y.M.T., 1935.
SURFACE ELEVATIONS ARE CORRECT
ONLY AT TEST BORING LOCATIONS.
THE DEPTH AND THICKNESS OF THE
SOIL STRATA AND THE DEPTH OF THE
ROCK STRATA INDICATED ON THE SUB-
SURFACE SECTION WERE OBTAINED BY
INTERPOLATING BETWEEN TEST BOR-
INGS. INFORMATION ON ACTUAL SOIL
AND ROCK CONDITIONS EXISTS ONLY
AT THE TEST BORING LOCATIONS AND
IT IS POSSIBLE THAT THE SOIL AND
ROCK CONDITIONS BETWEEN THE TEST
BORINGS MAY VARY FROM THOSE
INDICATED.

REFERENCE
PLATE 6A



Fermi 2
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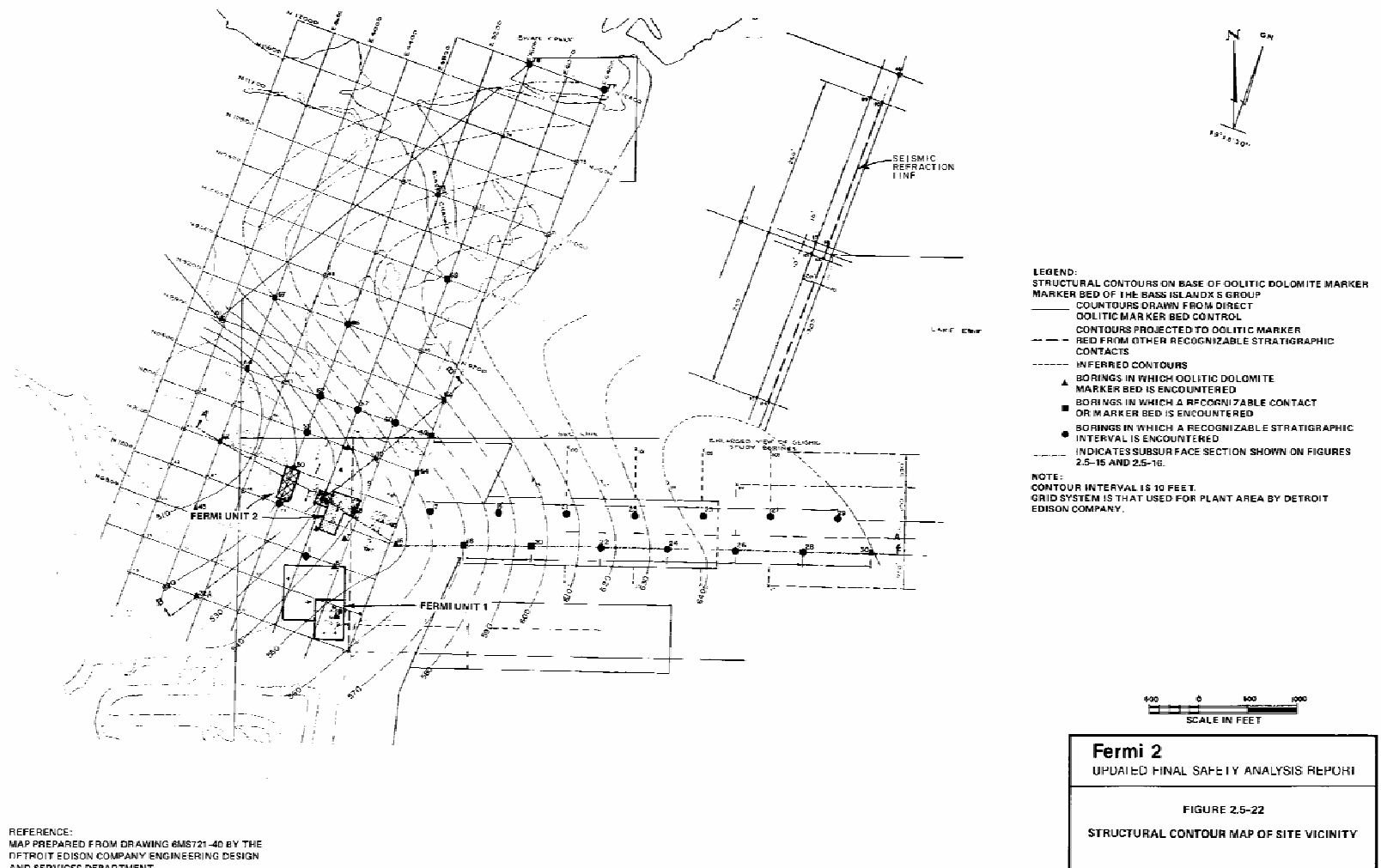
FIGURE 2.5-19
SUBSURFACE SECTION E-E' FROM
FIGURE 2.5-14

REV 1 3/88

Site Structural Geology

- No faults
- Shallow synclinal fold trending N60°W and plunging 1.5° NW – strata dip ~4° SW and ~1.5°NE
- Bass Islands dolomite jointed w/ vertical joint open to filled with gypsum, anhydrite, or selenite
- Bass Islands joints trend N21-60°W and N50-72°E
- Bass Islands vuggy zones up to 2 in. max and creating up to 30% open space

Site Structural Geology -Syncline



Summary of Site Stratigraphy

Stratum		Thickness	General Description
Lacustrine Deposit		0-12 feet	Peaty silt and clay (Removed).
Rock Fill		0-16 feet	Fill, gravel with cobbles and boulders.
Glacial Till		Up to 20 feet	Impermeable clay with sand and gravel.
Bass Islands Group		Up to 95 feet	Dolomite; variable degree of fractures; relatively tight and discontinuous joints with minor solution activity.
Salina	Unit G	~ 60 feet	Shales, dolomitic shale, and argillaceous dolomites.
	Unit E	~ 30 feet	Shaly dolomite, dolomitic limestone, and limestone breccias; minor artesian groundwater flow.
	Unit C	~250 feet	Buff, brown to greenish gray dolomite and anhydrite.
	Unit A	>20 feet	Brown dolomite and anhydrite.

BORING NO.	ELEV.	CORRELATION	DEPTH
1	571.0	6780 5250	36.6'
2	571.0	6780 5250	36.6'
3	571.0	6780 5250	36.6'
4	571.0	6780 5250	36.6'
5	571.0	6780 5250	36.6'
6	571.0	6780 5250	36.6'
7	571.0	6780 5250	36.6'
8	571.0	6780 5250	36.6'
9	571.0	6780 5250	36.6'
10	571.0	6780 5250	36.6'
11	571.0	6780 5250	36.6'
12	571.0	6780 5250	36.6'
13	571.0	6780 5250	36.6'
14	571.0	6780 5250	36.6'
15	571.0	6780 5250	36.6'
16	571.0	6780 5250	36.6'
17	571.0	6780 5250	36.6'
18	571.0	6780 5250	36.6'
19	571.0	6780 5250	36.6'
20	571.0	6780 5250	36.6'
21	571.0	6780 5250	36.6'
22	571.0	6780 5250	36.6'
23	571.0	6780 5250	36.6'
24	571.0	6780 5250	36.6'
25	571.0	6780 5250	36.6'
26	571.0	6780 5250	36.6'
27	571.0	6780 5250	36.6'
28	571.0	6780 5250	36.6'
29	571.0	6780 5250	36.6'
30	571.0	6780 5250	36.6'
31	571.0	6780 5250	36.6'
32	571.0	6780 5250	36.6'
33	571.0	6780 5250	36.6'
34	571.0	6780 5250	36.6'
35	571.0	6780 5250	36.6'
36	571.0	6780 5250	36.6'
37	571.0	6780 5250	36.6'
38	571.0	6780 5250	36.6'
39	571.0	6780 5250	36.6'
40	571.0	6780 5250	36.6'
41	571.0	6780 5250	36.6'
42	571.0	6780 5250	36.6'
43	571.0	6780 5250	36.6'
44	571.0	6780 5250	36.6'
45	571.0	6780 5250	36.6'
46	571.0	6780 5250	36.6'
47	571.0	6780 5250	36.6'
48	571.0	6780 5250	36.6'
49	571.0	6780 5250	36.6'
50	571.0	6780 5250	36.6'
51	571.0	6780 5250	36.6'
52	571.0	6780 5250	36.6'
53	571.0	6780 5250	36.6'
54	571.0	6780 5250	36.6'
55	571.0	6780 5250	36.6'
56	571.0	6780 5250	36.6'
57	571.0	6780 5250	36.6'
58	571.0	6780 5250	36.6'
59	571.0	6780 5250	36.6'
60	571.0	6780 5250	36.6'
61	571.0	6780 5250	36.6'
62	571.0	6780 5250	36.6'
63	571.0	6780 5250	36.6'
64	571.0	6780 5250	36.6'
65	571.0	6780 5250	36.6'
66	571.0	6780 5250	36.6'
67	571.0	6780 5250	36.6'
68	571.0	6780 5250	36.6'
69	571.0	6780 5250	36.6'
70	571.0	6780 5250	36.6'
71	571.0	6780 5250	36.6'
72	571.0	6780 5250	36.6'
73	571.0	6780 5250	36.6'
74	571.0	6780 5250	36.6'
75	571.0	6780 5250	36.6'
76	571.0	6780 5250	36.6'
77	571.0	6780 5250	36.6'
78	571.0	6780 5250	36.6'
79	571.0	6780 5250	36.6'
80	571.0	6780 5250	36.6'
81	571.0	6780 5250	36.6'
82	571.0	6780 5250	36.6'
83	571.0	6780 5250	36.6'
84	571.0	6780 5250	36.6'
85	571.0	6780 5250	36.6'
86	571.0	6780 5250	36.6'
87	571.0	6780 5250	36.6'
88	571.0	6780 5250	36.6'
89	571.0	6780 5250	36.6'
90	571.0	6780 5250	36.6'
91	571.0	6780 5250	36.6'
92	571.0	6780 5250	36.6'
93	571.0	6780 5250	36.6'
94	571.0	6780 5250	36.6'
95	571.0	6780 5250	36.6'
96	571.0	6780 5250	36.6'
97	571.0	6780 5250	36.6'
98	571.0	6780 5250	36.6'
99	571.0	6780 5250	36.6'
100	571.0	6780 5250	36.6'

BORING NO.	ELEV.	CORRELATION	DEPTH
68	571.0	8600 4400	21.0'
69	571.0	8600 4400	21.0'
70	571.0	8600 4400	21.0'
71	571.0	8600 4400	21.0'
72	571.0	8600 4400	21.0'
73	571.0	8600 4400	21.0'
74	571.0	8600 4400	21.0'
75	571.0	8600 4400	21.0'
76	571.0	8600 4400	21.0'
77	571.0	8600 4400	21.0'
78	571.0	8600 4400	21.0'
79	571.0	8600 4400	21.0'
80	571.0	8600 4400	21.0'
81	571.0	8600 4400	21.0'
82	571.0	8600 4400	21.0'
83	571.0	8600 4400	21.0'
84	571.0	8600 4400	21.0'
85	571.0	8600 4400	21.0'
86	571.0	8600 4400	21.0'
87	571.0	8600 4400	21.0'
88	571.0	8600 4400	21.0'
89	571.0	8600 4400	21.0'
90	571.0	8600 4400	21.0'
91	571.0	8600 4400	21.0'
92	571.0	8600 4400	21.0'
93	571.0	8600 4400	21.0'
94	571.0	8600 4400	21.0'
95	571.0	8600 4400	21.0'
96	571.0	8600 4400	21.0'
97	571.0	8600 4400	21.0'
98	571.0	8600 4400	21.0'
99	571.0	8600 4400	21.0'
100	571.0	8600 4400	21.0'

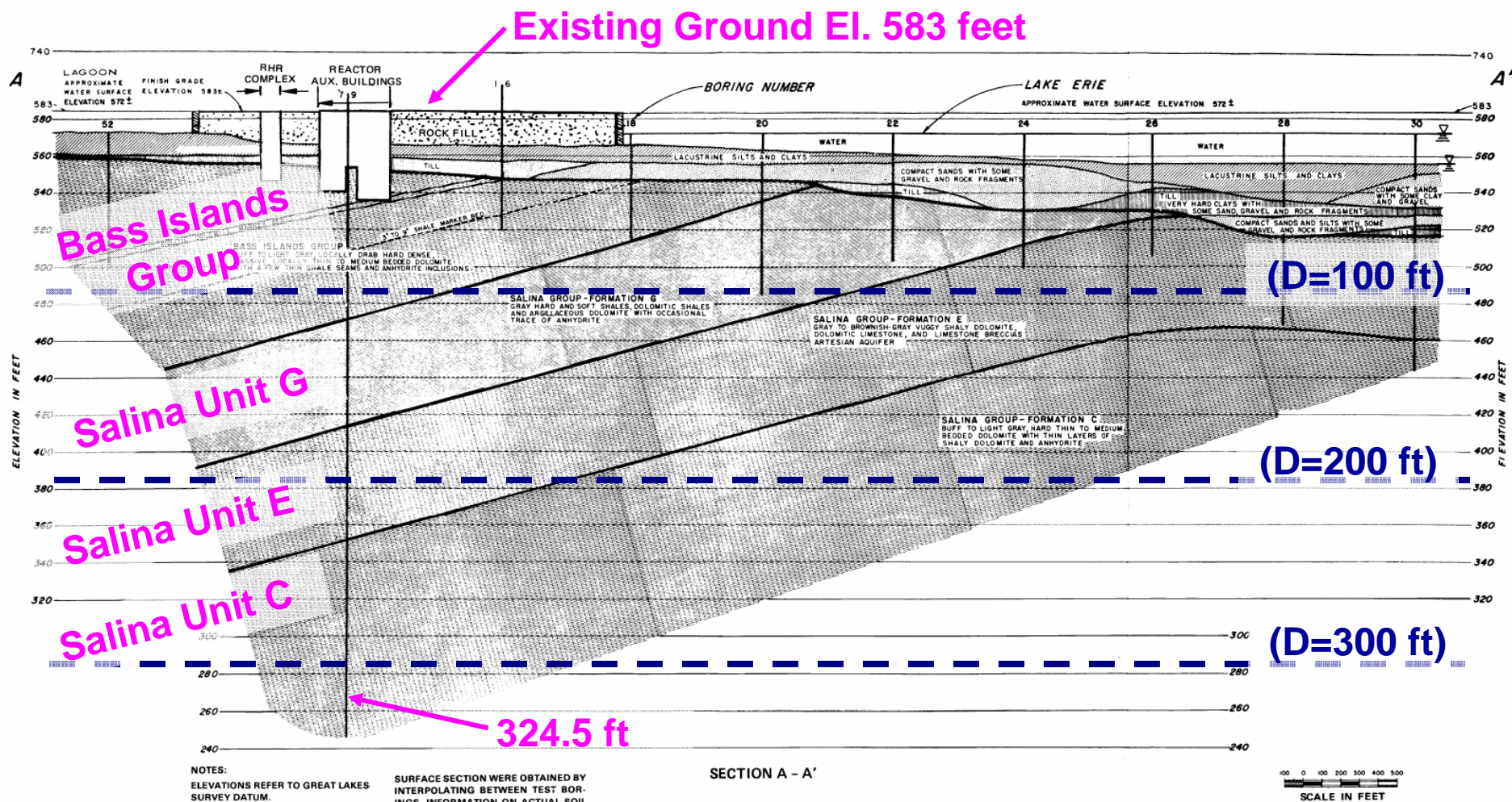
**Proposed Fermi 3
Site Location**

**Existing Fermi 2
Site Location**

- INDICATES PROPOSED BORING LOCATIONS FOR UNIT NO. 2 (201-21)
- ⊕ INDICATES PROPOSED BORING LOCATIONS FOR UNIT NO. 2 (106-124)
- ★ INDICATES BORING LOCATION TAKEN FOR UNIT NO. 1
- ▲ INDICATES PROPOSED BORING LOCATIONS FOR UNIT NO. 2 (1-31)
- INDICATES PROPOSED INLAND BORING LOCATIONS FOR UNIT NO. 2 (31-78)
- ⊙ INDICATES DEEP BORING LOCATION
- INDICATES BORING LOCATIONS FOR SEISMIC SOIL RESPONSE STUDY
- ✱ INDICATES BORING LOCATIONS TO BOTTOM OF SAND STRATUM

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FIGURE 2.5-13
BORING PLAN – SITE VICINITY



From Detroit Edison Fermi 2 UFSAR, Figure 2.5-15
(Soil/Rock Profile through Section A-A')

BORING NO.	ELEV.	CORRELATES	DEPTH
1	571.0	6780 5250 36.6'	
2	571.0	7880 5250 36.6'	
3	572.4	7880 5250 36.6'	
4	572.4	7880 5250 36.6'	
5	573.4	7880 5250 36.6'	
6	573.4	7880 5250 36.6'	
7	572.7	7880 5250 36.6'	
8	572.7	7880 5250 36.6'	
9	573.4	7880 5250 36.6'	
10	573.4	7880 5250 36.6'	
11	573.4	7880 5250 36.6'	
12	573.4	7880 5250 36.6'	
13	573.4	7880 5250 36.6'	
14	573.4	7880 5250 36.6'	
15	573.4	7880 5250 36.6'	
16	573.4	7880 5250 36.6'	
17	573.4	7880 5250 36.6'	
18	573.4	7880 5250 36.6'	
19	573.4	7880 5250 36.6'	
20	573.4	7880 5250 36.6'	
21	573.4	7880 5250 36.6'	
22	573.4	7880 5250 36.6'	
23	573.4	7880 5250 36.6'	
24	573.4	7880 5250 36.6'	
25	573.4	7880 5250 36.6'	
26	573.4	7880 5250 36.6'	
27	573.4	7880 5250 36.6'	
28	573.4	7880 5250 36.6'	
29	573.4	7880 5250 36.6'	
30	573.4	7880 5250 36.6'	
31	573.4	7880 5250 36.6'	
32	573.4	7880 5250 36.6'	
33	573.4	7880 5250 36.6'	
34	573.4	7880 5250 36.6'	
35	573.4	7880 5250 36.6'	
36	573.4	7880 5250 36.6'	
37	573.4	7880 5250 36.6'	
38	573.4	7880 5250 36.6'	
39	573.4	7880 5250 36.6'	
40	573.4	7880 5250 36.6'	
41	573.4	7880 5250 36.6'	
42	573.4	7880 5250 36.6'	
43	573.4	7880 5250 36.6'	
44	573.4	7880 5250 36.6'	
45	573.4	7880 5250 36.6'	
46	573.4	7880 5250 36.6'	
47	573.4	7880 5250 36.6'	
48	573.4	7880 5250 36.6'	
49	573.4	7880 5250 36.6'	
50	573.4	7880 5250 36.6'	
51	573.4	7880 5250 36.6'	
52	573.4	7880 5250 36.6'	
53	573.4	7880 5250 36.6'	
54	573.4	7880 5250 36.6'	
55	573.4	7880 5250 36.6'	
56	573.4	7880 5250 36.6'	
57	573.4	7880 5250 36.6'	

BORING NO.	ELEV.	CORRELATES	DEPTH
58	573.1	8600 4400 21.0'	
59	572.8	8600 4400 21.0'	
60	572.8	8600 4400 21.0'	
61	572.8	8600 4400 21.0'	
62	572.8	8600 4400 21.0'	
63	572.8	8600 4400 21.0'	
64	572.8	8600 4400 21.0'	
65	572.8	8600 4400 21.0'	
66	572.8	8600 4400 21.0'	
67	572.8	8600 4400 21.0'	
68	572.8	8600 4400 21.0'	
69	572.8	8600 4400 21.0'	
70	572.8	8600 4400 21.0'	
71	572.8	8600 4400 21.0'	
72	572.8	8600 4400 21.0'	
73	572.8	8600 4400 21.0'	
74	572.8	8600 4400 21.0'	
75	572.8	8600 4400 21.0'	
76	572.8	8600 4400 21.0'	
77	572.8	8600 4400 21.0'	
78	572.8	8600 4400 21.0'	
79	572.8	8600 4400 21.0'	
80	572.8	8600 4400 21.0'	
81	572.8	8600 4400 21.0'	
82	572.8	8600 4400 21.0'	
83	572.8	8600 4400 21.0'	
84	572.8	8600 4400 21.0'	
85	572.8	8600 4400 21.0'	
86	572.8	8600 4400 21.0'	
87	572.8	8600 4400 21.0'	
88	572.8	8600 4400 21.0'	
89	572.8	8600 4400 21.0'	
90	572.8	8600 4400 21.0'	
91	572.8	8600 4400 21.0'	
92	572.8	8600 4400 21.0'	
93	572.8	8600 4400 21.0'	
94	572.8	8600 4400 21.0'	
95	572.8	8600 4400 21.0'	
96	572.8	8600 4400 21.0'	
97	572.8	8600 4400 21.0'	
98	572.8	8600 4400 21.0'	
99	572.8	8600 4400 21.0'	
100	572.8	8600 4400 21.0'	
101	572.8	8600 4400 21.0'	
102	572.8	8600 4400 21.0'	
103	572.8	8600 4400 21.0'	
104	572.8	8600 4400 21.0'	
105	572.8	8600 4400 21.0'	
106	572.8	8600 4400 21.0'	
107	572.8	8600 4400 21.0'	

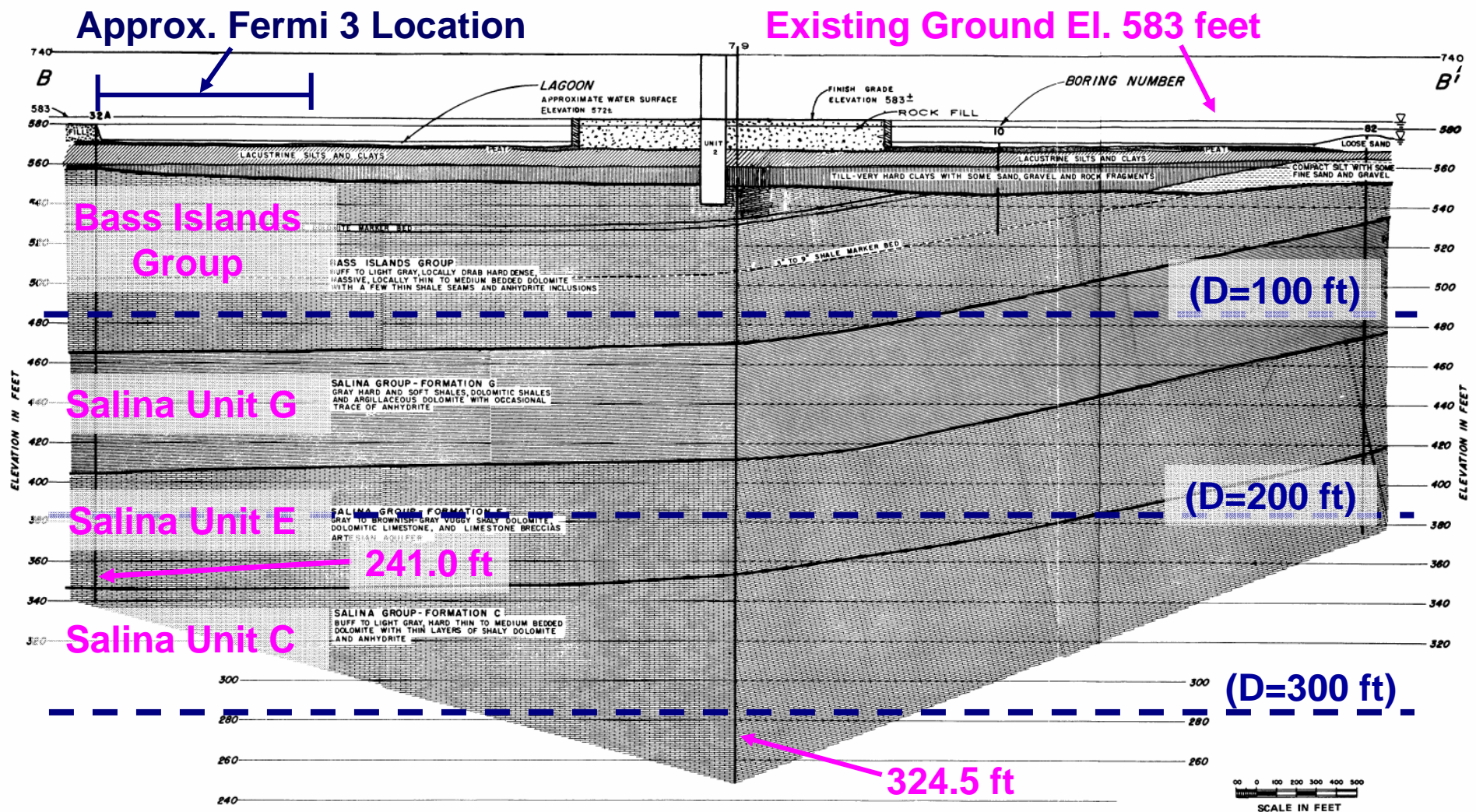
**Proposed Fermi 3
Site Location**

**Existing Fermi 2
Site Location**

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- ⊕ INDICATES PROPOSED BORING LOCATIONS FOR UNIT NO. 2 (106-124)
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- ⊙ INDICATES DEEP BORING LOCATION
- ⊙ INDICATES BORING LOCATIONS FOR SEISMIC SOIL RESPONSE STUDY
- ✱ INDICATES BORING LOCATIONS TO BOTTOM OF SAND STRATUM

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FIGURE 2.5-13
BORING PLAN – SITE VICINITY



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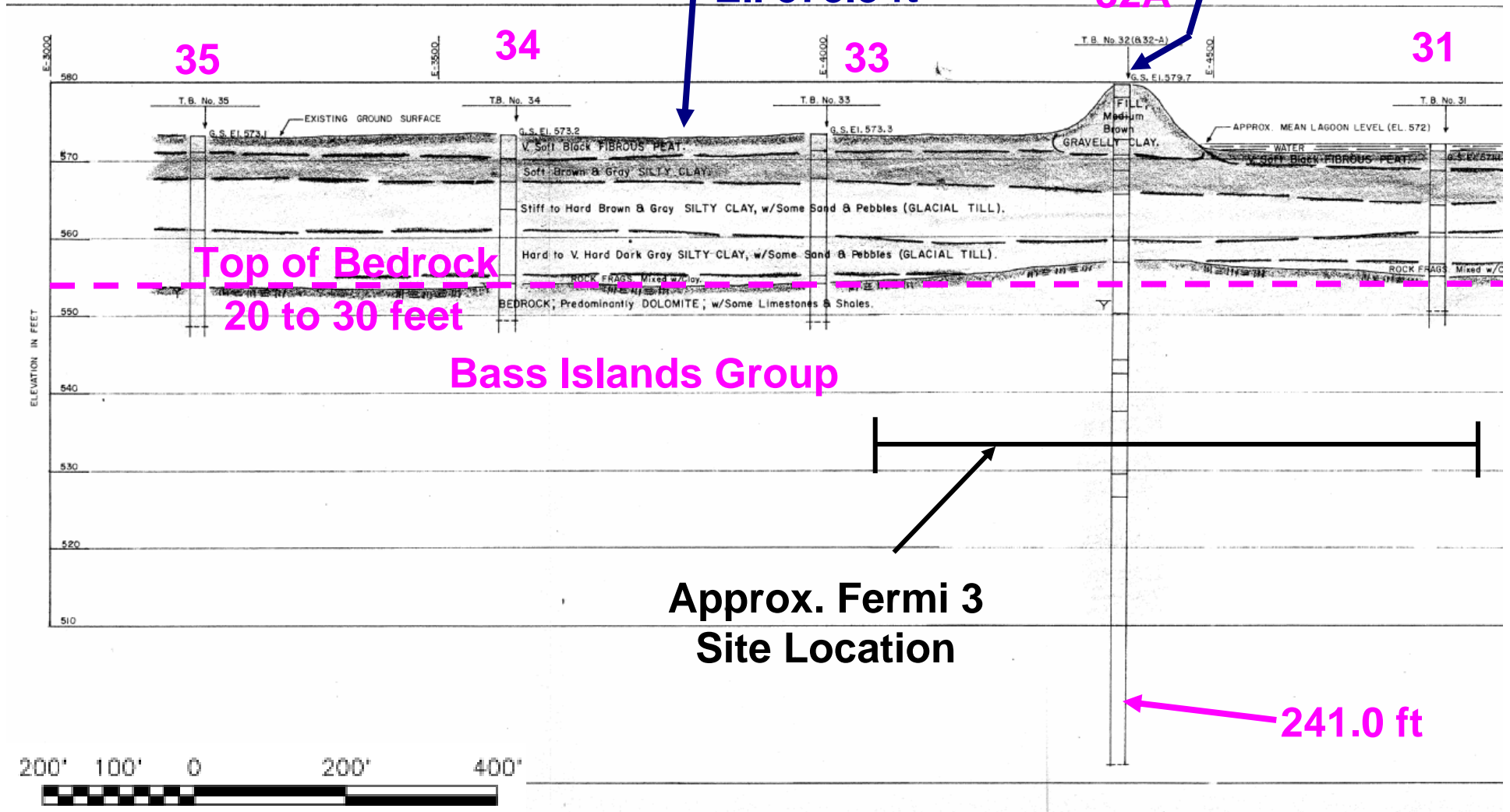
FIGURE 2.5-16
SUBSURFACE SECTION B-B' FROM
FIGURE 2.5-13

**From Detroit Edison Fermi 2 UFSAR, Figure 2.5-16
(Soil/Rock Profile through Section B-B')**

Fermi 3 Cross Section C-C'

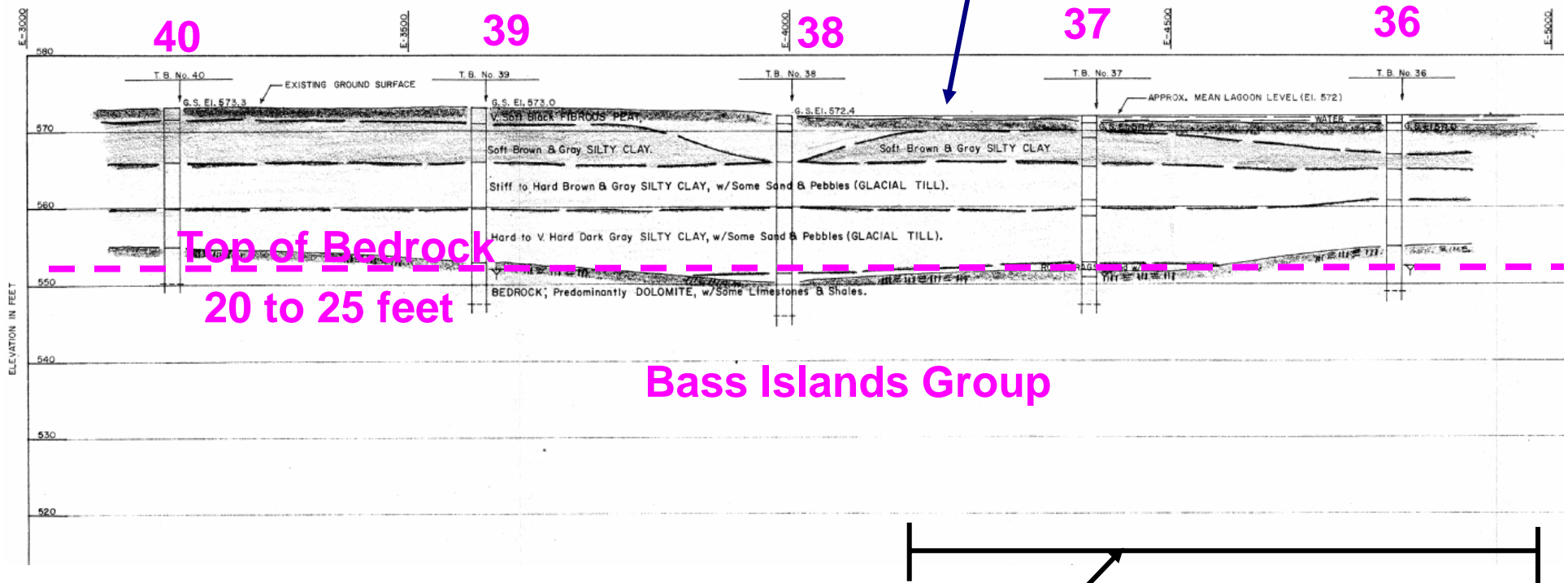
Previous Ground
El. 573.3 ft

Previous Ground
El. 579.7 ft



Fermi 3 Cross Section D-D'

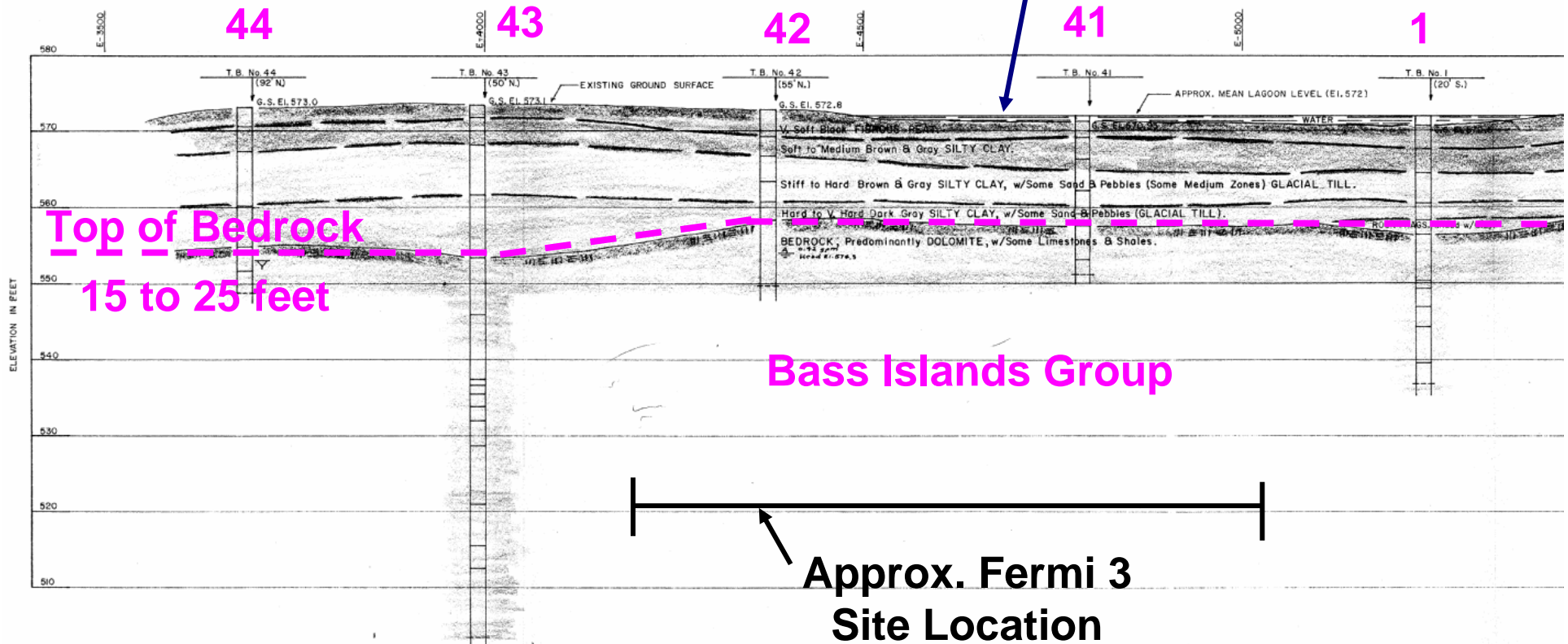
Previous Ground El. 572.4 ft



**Approx. Fermi 3
Site Location**

Fermi 3 Cross Section E-E'

Previous Ground El. 572.0 ft

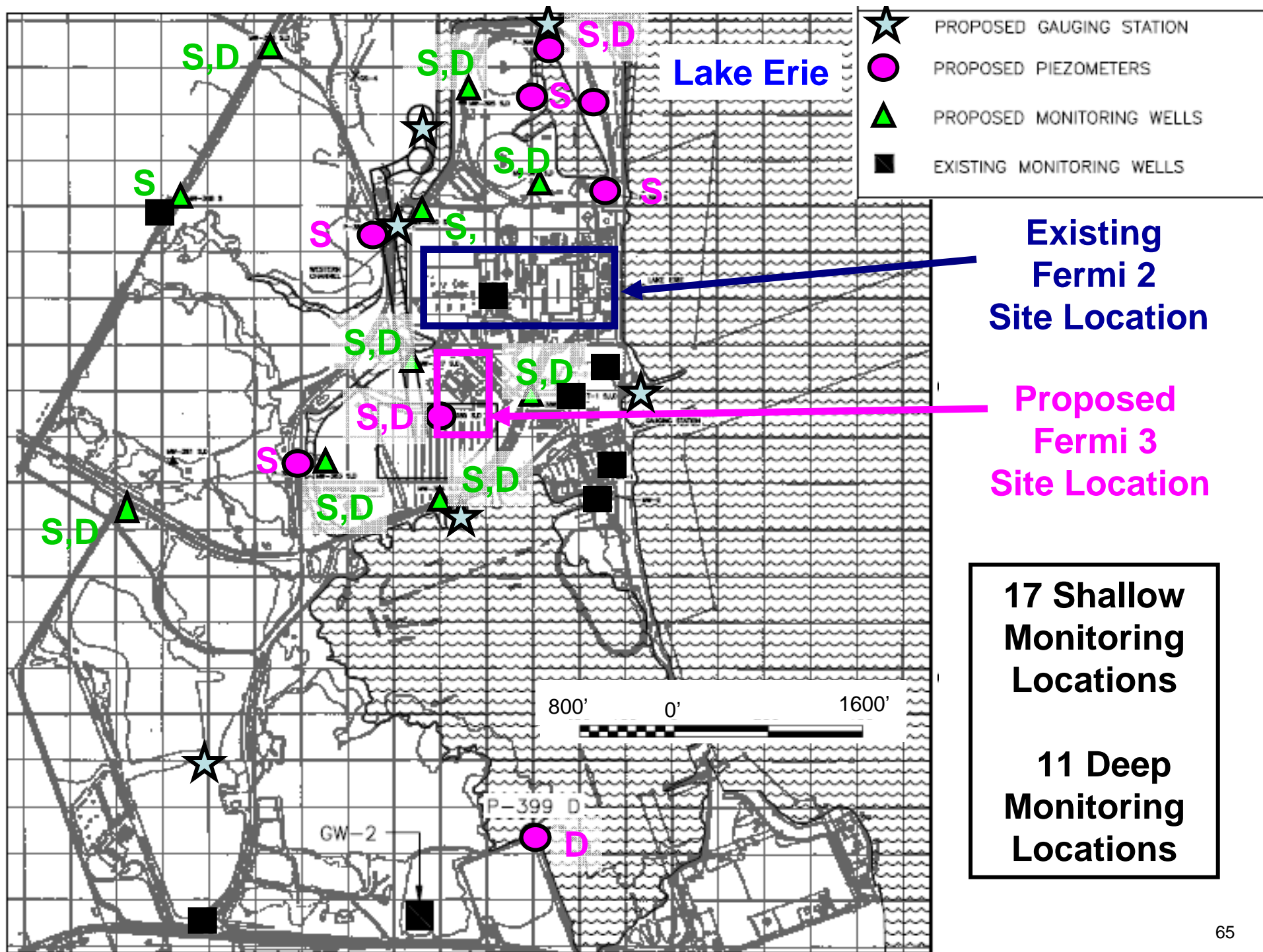


Subsurface Investigations Overview

Ed Meyer
Geotechnical Engineer
(Black & Veatch)

Hydrogeology Investigation Overview

- Installation of 11 deep monitoring wells/piezometers within the bedrock.
- Installation of 17 shallow piezometers/monitoring wells within the overburden.
- Installation of 5 staff gauges in surface water.
- Monitoring groundwater and surface water elevations for a one year period.
- Performed packer testing in bedrock and slug testing in soil to evaluate hydraulic conductivity.
- Preparing to sample and analyze monitoring wells and surface water to provide water quality.



Hydrogeology Investigation Overview

- Shallow piezometers/monitoring wells set at top of gray till layer.
- Deep piezometers/monitoring wells set in higher flow interval of Bass Islands Formation based on packer tests.

Geotechnical Investigation Overview

The Geotechnical Investigation Plan was developed based on:

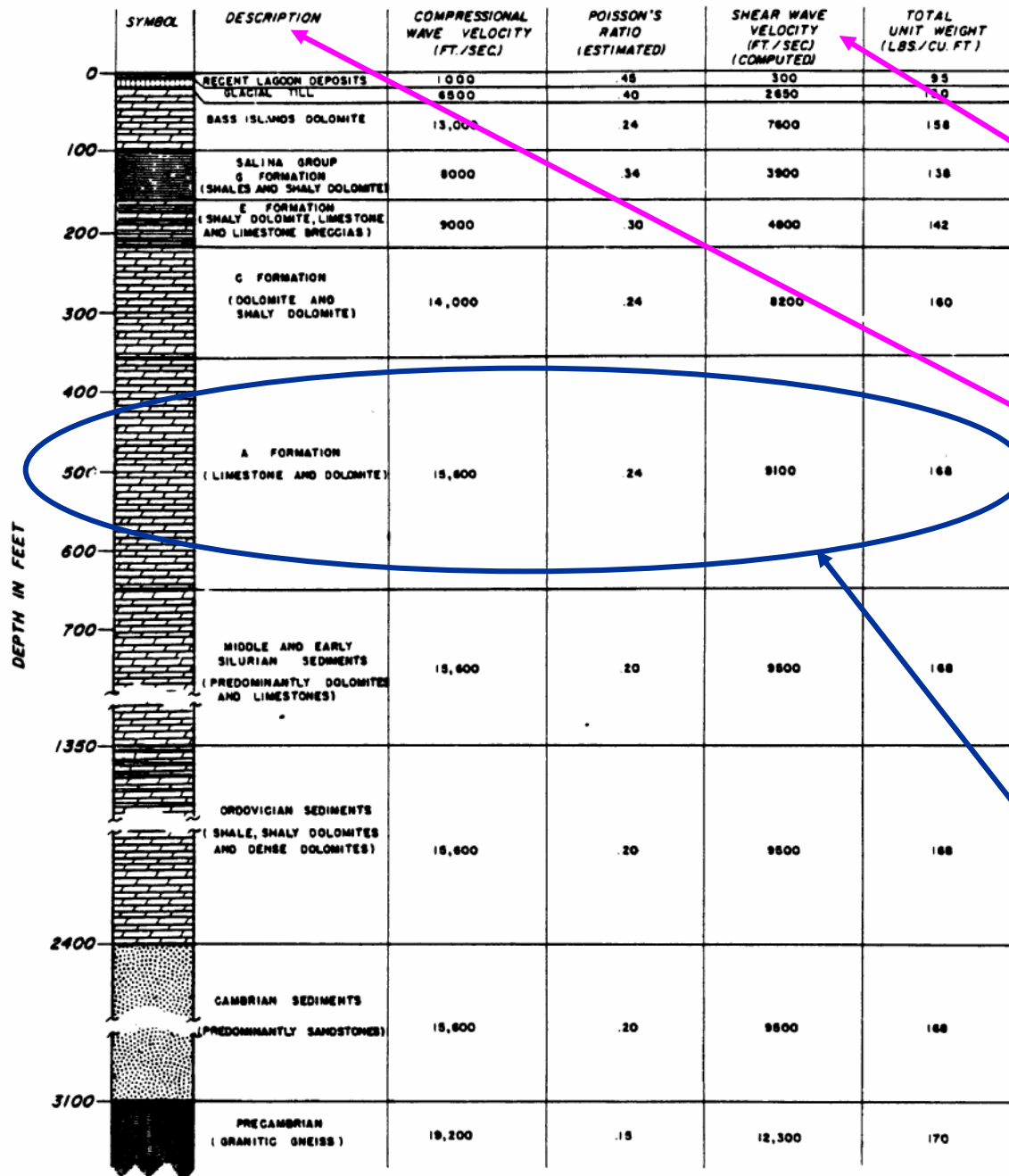
- US NRC **RG 1.132** -- Site Investigations for Foundations of Nuclear Power Plants.
- US NRC, **RG 1.208** -- A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion.
- US NRC, **NUREG/CR-5738** -- Field Investigations for Foundations of Nuclear Power Facilities, US Army Corps of Engineers.
- Discussions with the TAB and Geomatrix.

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 2.5-58

STRATIGRAPHIC COLUMN SHOWING
GEOPHYSICAL DATA



Computed
Shear Wave
Velocity
(ft/sec)

Description

Lacastrine	300
Galcial Till	2650
Bass Islands	7600
Saline (G)	3900
Saline (E)	4800
Saline (C)	8200
Saline (A)	9100
Silurian	9500
Ordovician	9500
Cambrian	9500
Pre-Cambrian	12300

From Detroit Edison Fermi 2 UFSAR, Figure 2.5-58

Fermi 3 Geotechnical Investigation

- Twenty-three common borings with depths ranging between 35 and 450 feet.
- Total boring lineal footage of approximately 4,900 feet.
- Two borings 450 feet deep for seismic measurements (RB-C8 and TB-C5):
 - P-S suspension logging
 - Downhole seismic logging
 - SASW (soil layers only)
 - Natural gamma and heat pulse flowmeter logging
 - Televiwer and caliper Logging
 - Borehole deviation survey

Fermi 3 Geotechnical Investigation

- Two borings 270 feet deep for rock pressuremeter testing.
- Two additional piezometers in the vicinity of the Fermi 3 site for groundwater level observations.
- Downhole logging:
 - Televiewer and caliper in the following borings:
 - Borings under safety-related structures.
 - Borings for seismic measurements.
 - Borings at deep cuts.
 - Borehole deviation survey in borings > 100 feet under safety-related structures)

Geotechnical Investigation

Soil and Rock Sampling:

- Soil samples will be collected at depth intervals no greater than 5 feet.
- At least one continuously sampled boring will be used for each safety-related structure.
- Continuous sampling in soil layers is considered as sampling on 2.5 foot intervals to the maximum depth of the boring or as sampling using continuous sonic sampling.
- Continuous sampling in bedrock is achieved by using continuous rock coring technique

Geotechnical Investigation

Soil and Rock Sampling:

- Continuous sampler using sonic drilling (ASTM D6914).
- Two inch split-barrel sampler (ASTM D1586).
- Three inch unlined or ring-lined split-barrel sampler (ASTM D3550).
- Three inch diameter thin-walled tube sampler (ASTM D1587).
- Pitcher sampler with a 3 inch thin-walled tube.
- Bag sampling.
- Rock coring (ASTM D 2113).

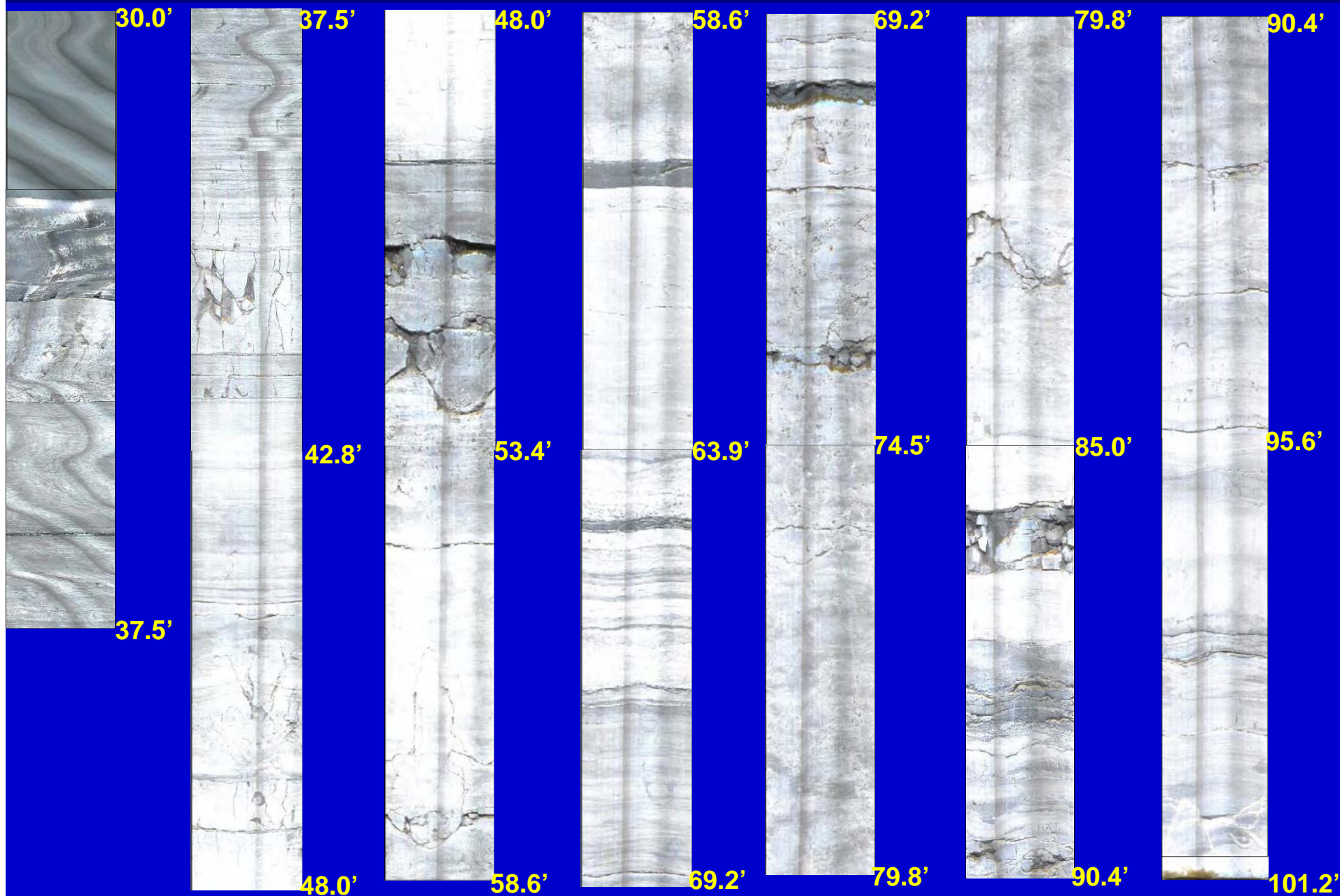
Laboratory Testing Program

- Tests are assigned by Black & Veatch after reviewing boring location (site structure) and boring log
- Subcontractor (PSI) performs laboratory tests
- Testing includes:
 - Index/Classification
 - Strength/Deformation
 - Dynamic Testing

Preliminary Geology Findings

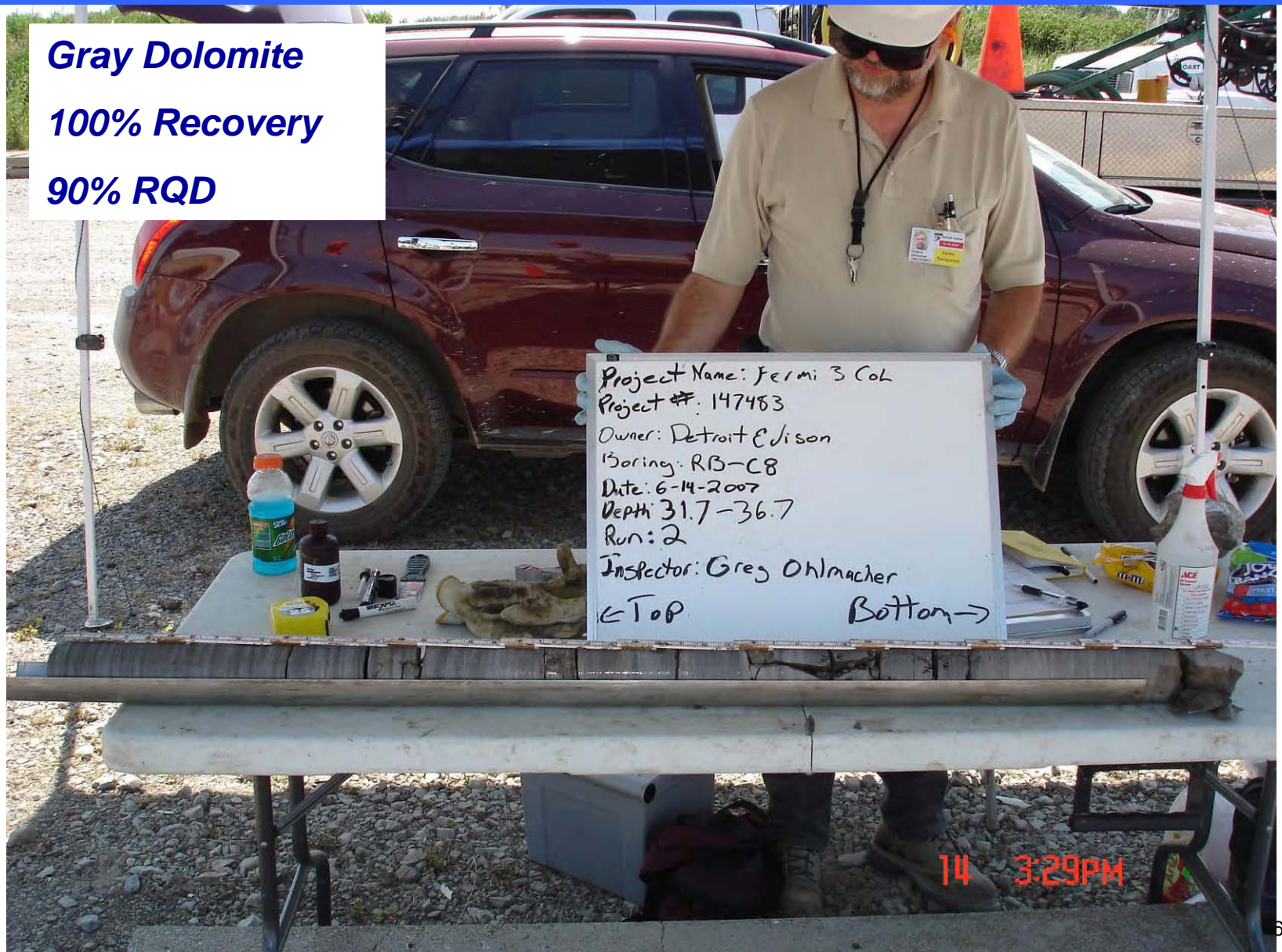
Gregory Ohlmacher
Senior Geologist
(Black & Veatch)

Optical Televiewer at MW-385D



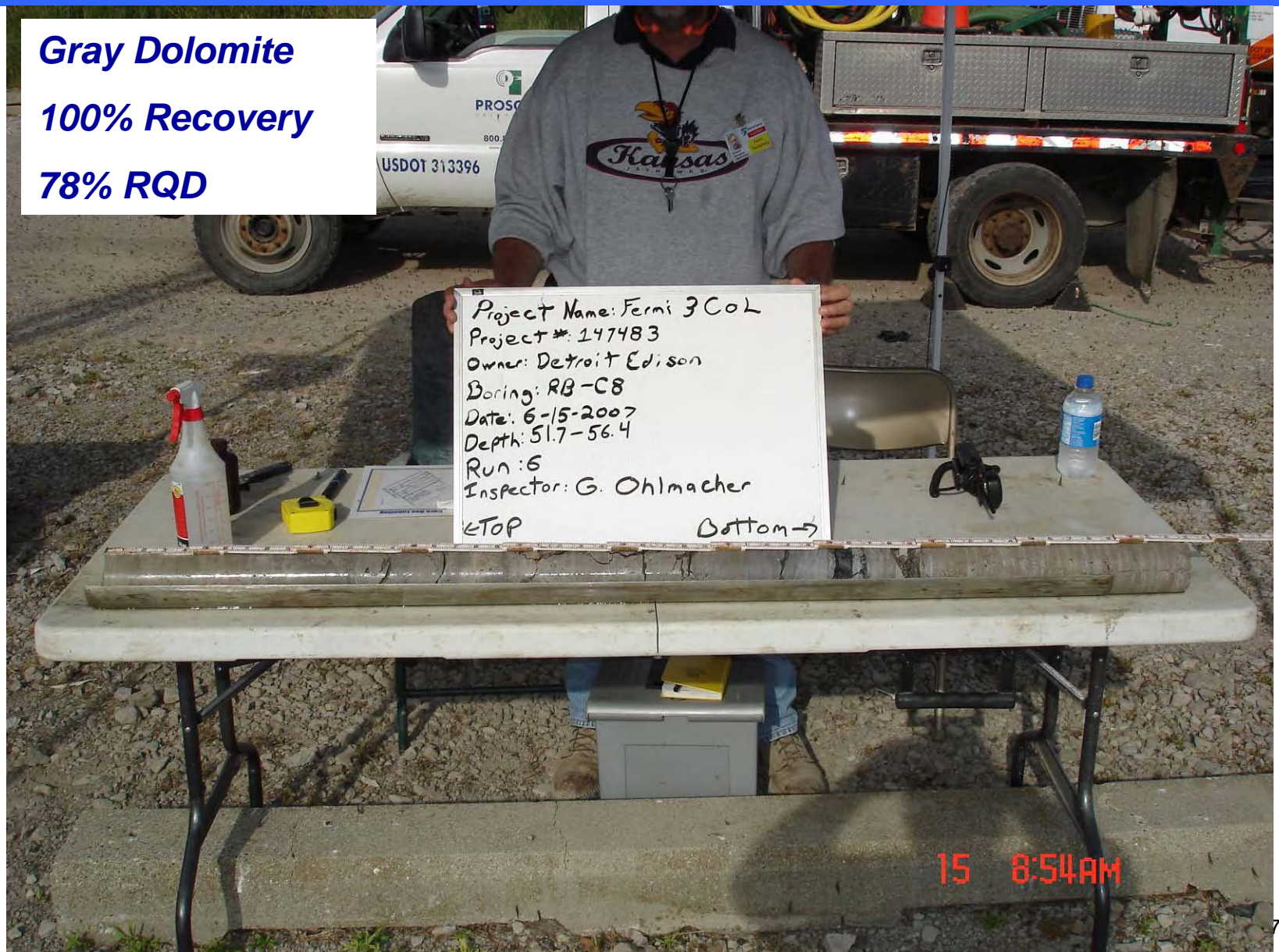
RB-C8 Bass Islands Group

Gray Dolomite
100% Recovery
90% RQD



RB-C8 Bass Islands Group

Gray Dolomite
100% Recovery
78% RQD



RB-C8 Bass Islands Group

**Black Shale &
Oolitic Dolomite**

Project Name: Fermi 3 COL
Project #: 147483
Owner: Detroit Edison
Boring: RB-C8
Date: 6-15-2007
Depth: 51.7-56.4
Run: 6
Inspector: G. Ohlman
←TOP Bottom→

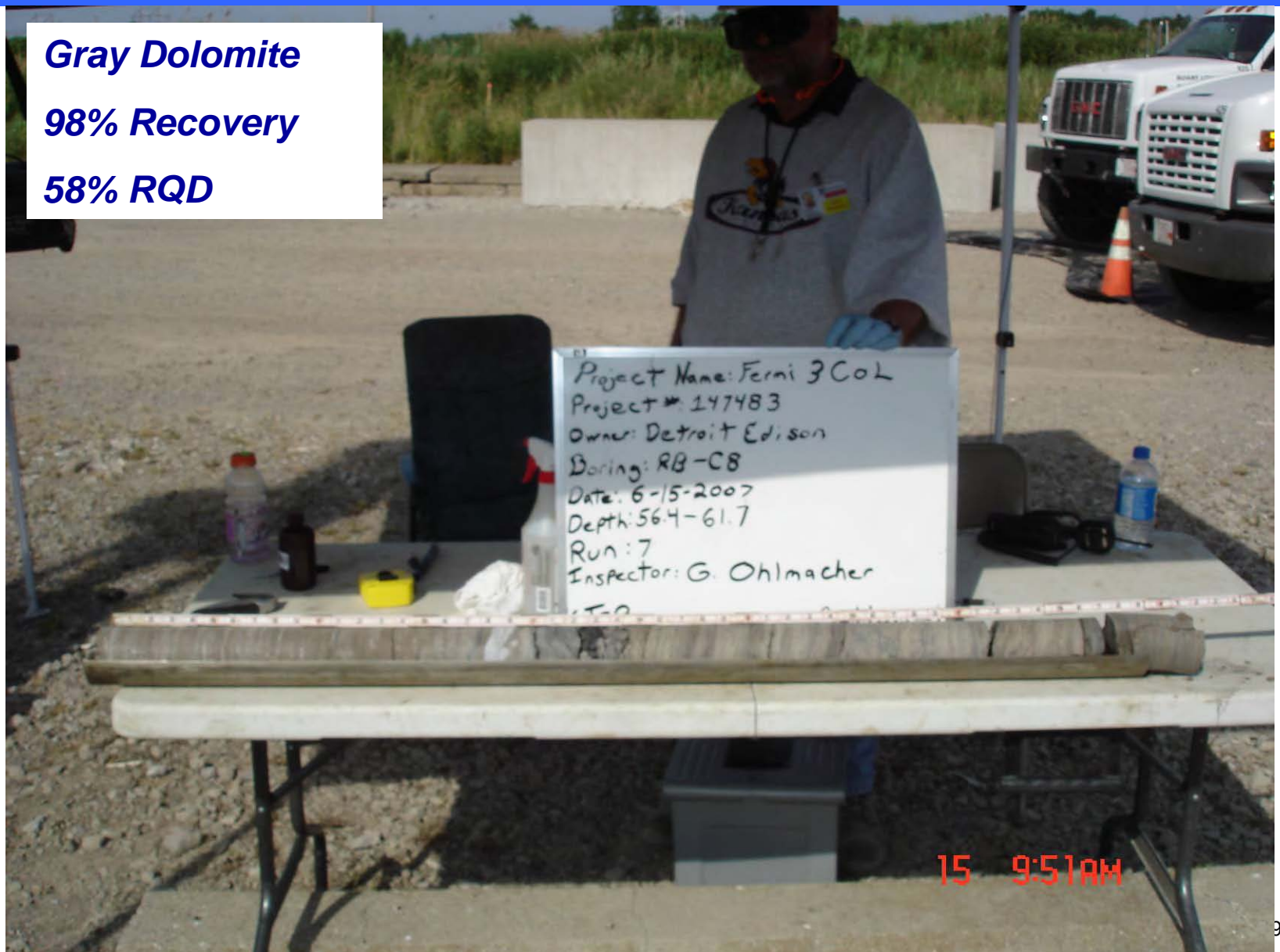
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RB-C8 Bass Islands Group

Gray Dolomite

98% Recovery

58% RQD



RB-C8 Bass Islands Group

Dolomite breccia



RB-C8 Bass Islands Group

***Dolomite breccia
& stylolites***



RB-C8 Bass Islands Group

Gray Dolomite

100% Recovery

10% RQD

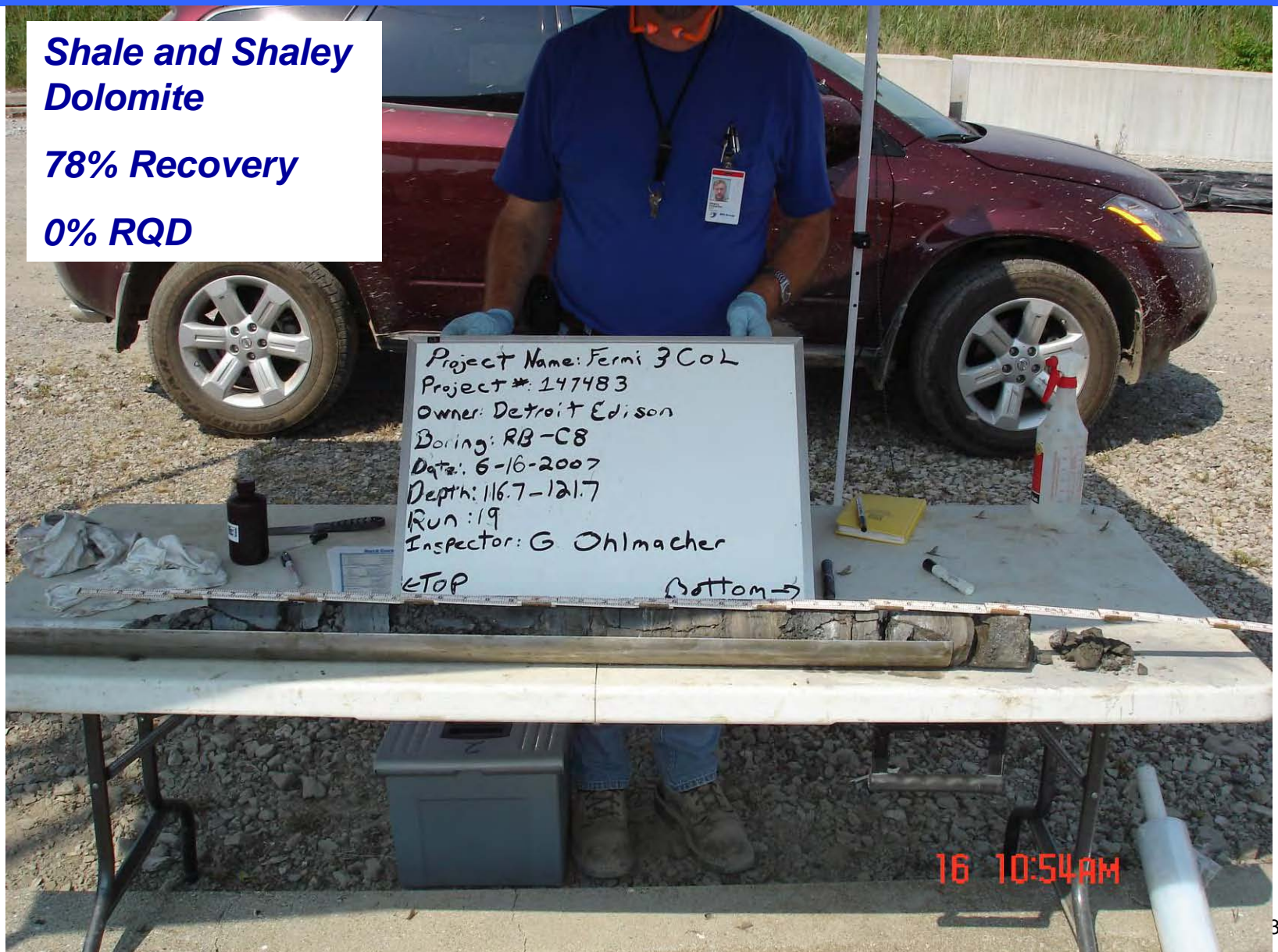


RB-C8 Salina Group Unit G

**Shale and Shaley
Dolomite**

78% Recovery

0% RQD

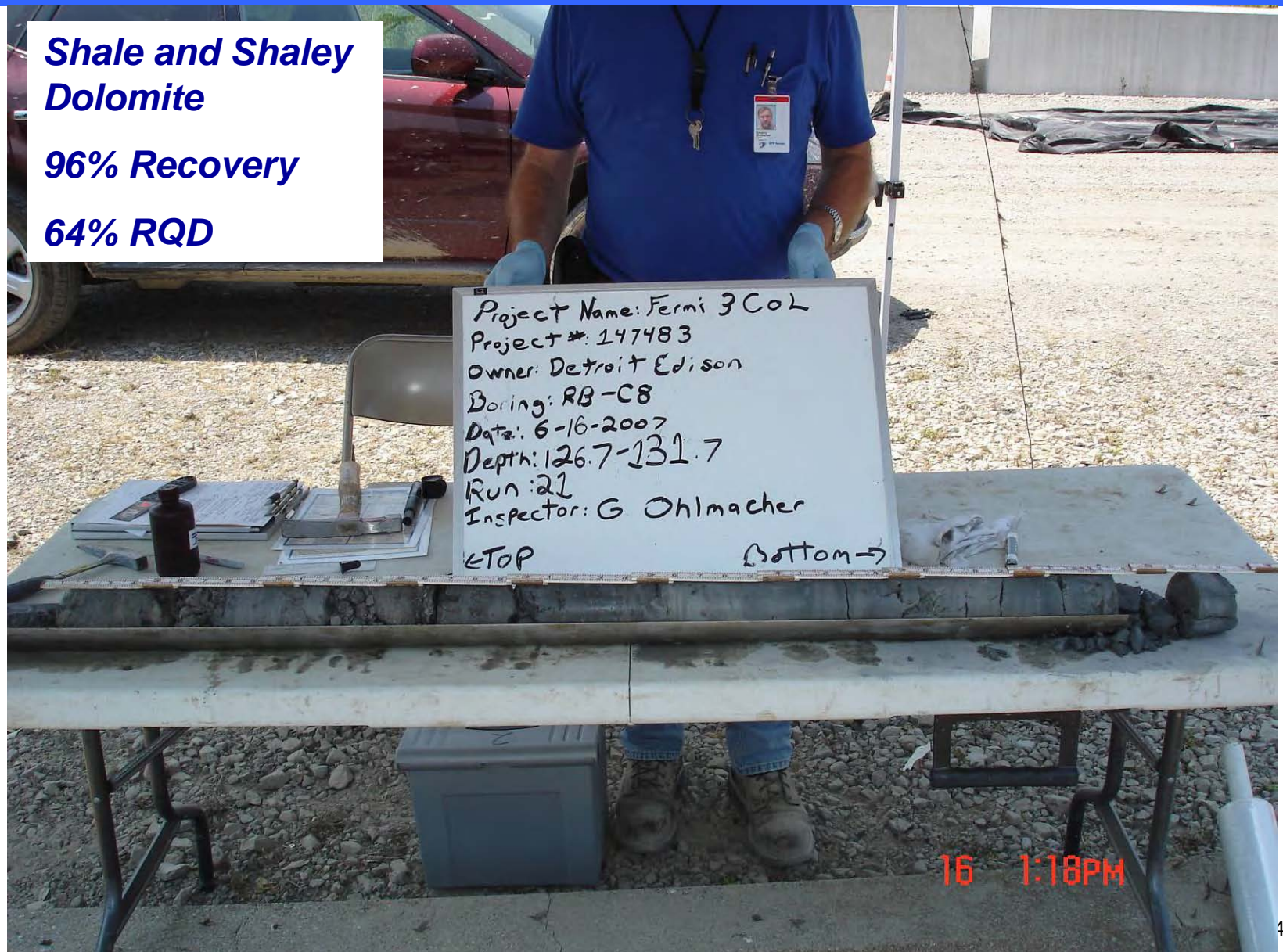


RB-C8 Salina Group Unit G

**Shale and Shaley
Dolomite**

96% Recovery

64% RQD

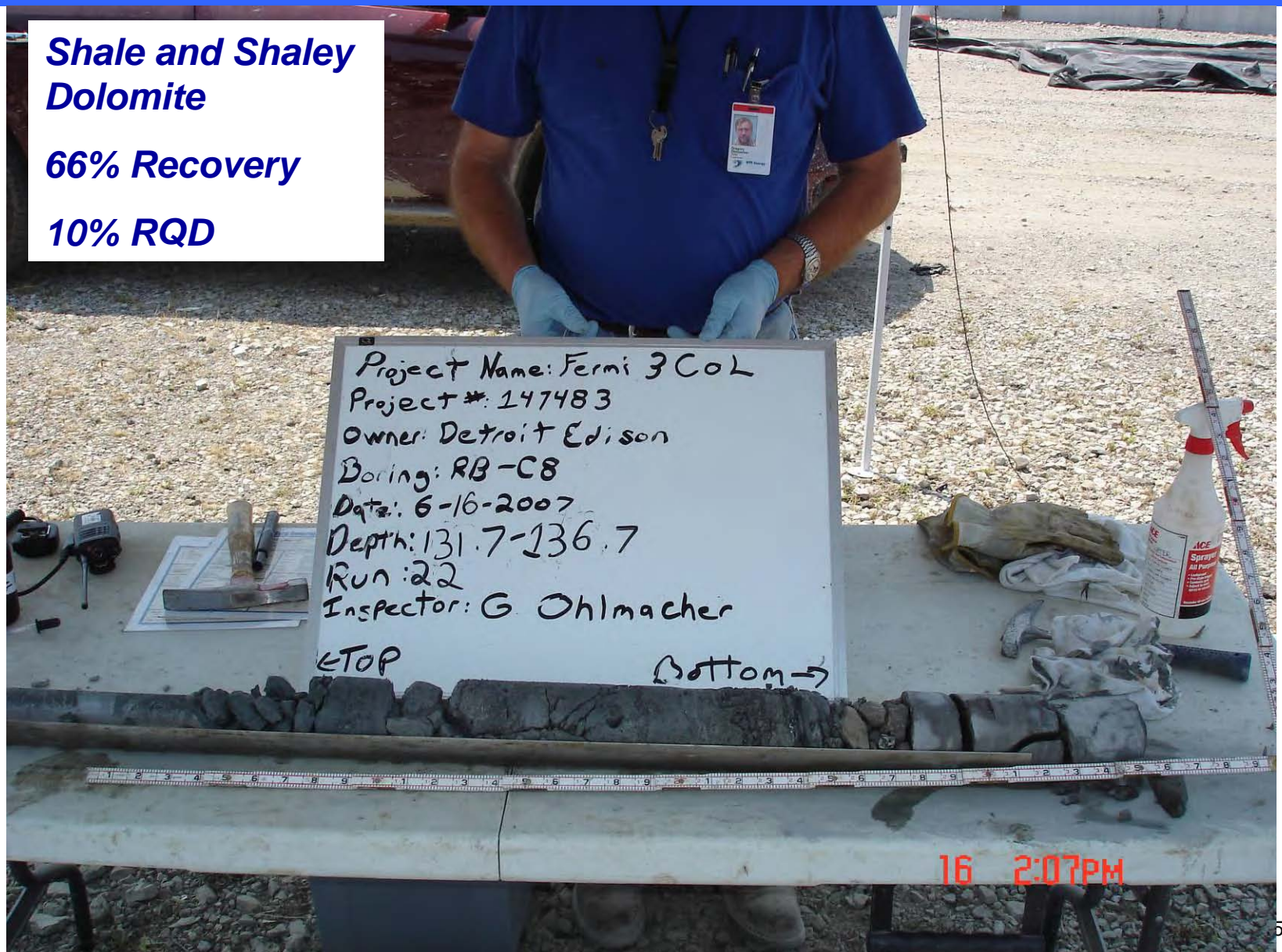


RB-C8 Salina Group Unit G

**Shale and Shaley
Dolomite**

66% Recovery

10% RQD



RB-C8 Salina Group Unit G

**Shale and Shaley
Dolomite**

60% Recovery

0% RQD

Project Name: Fermi 3 Co L

Project #: 147483

Owner: Detroit Edison

Boring: RB-C8

Date: 6-16-2007

Depth: 136.7-141.7

Run: 23

Inspector: G Ohlmacher

←TOP

Bottom→

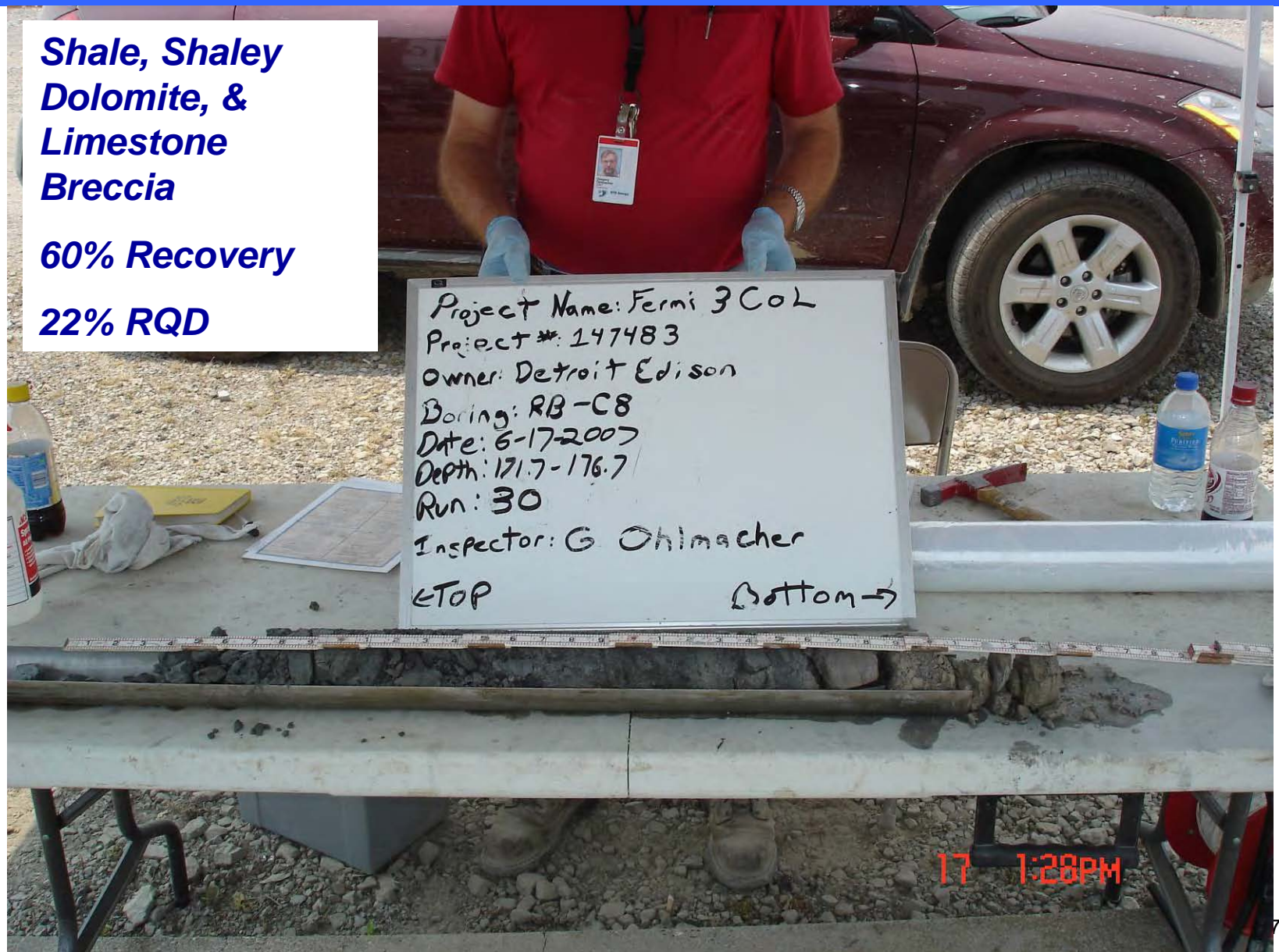
16 3:05PM

RB-C8 Salina Group Unit G-Unit E

**Shale, Shaley
Dolomite, &
Limestone
Breccia**

60% Recovery

22% RQD

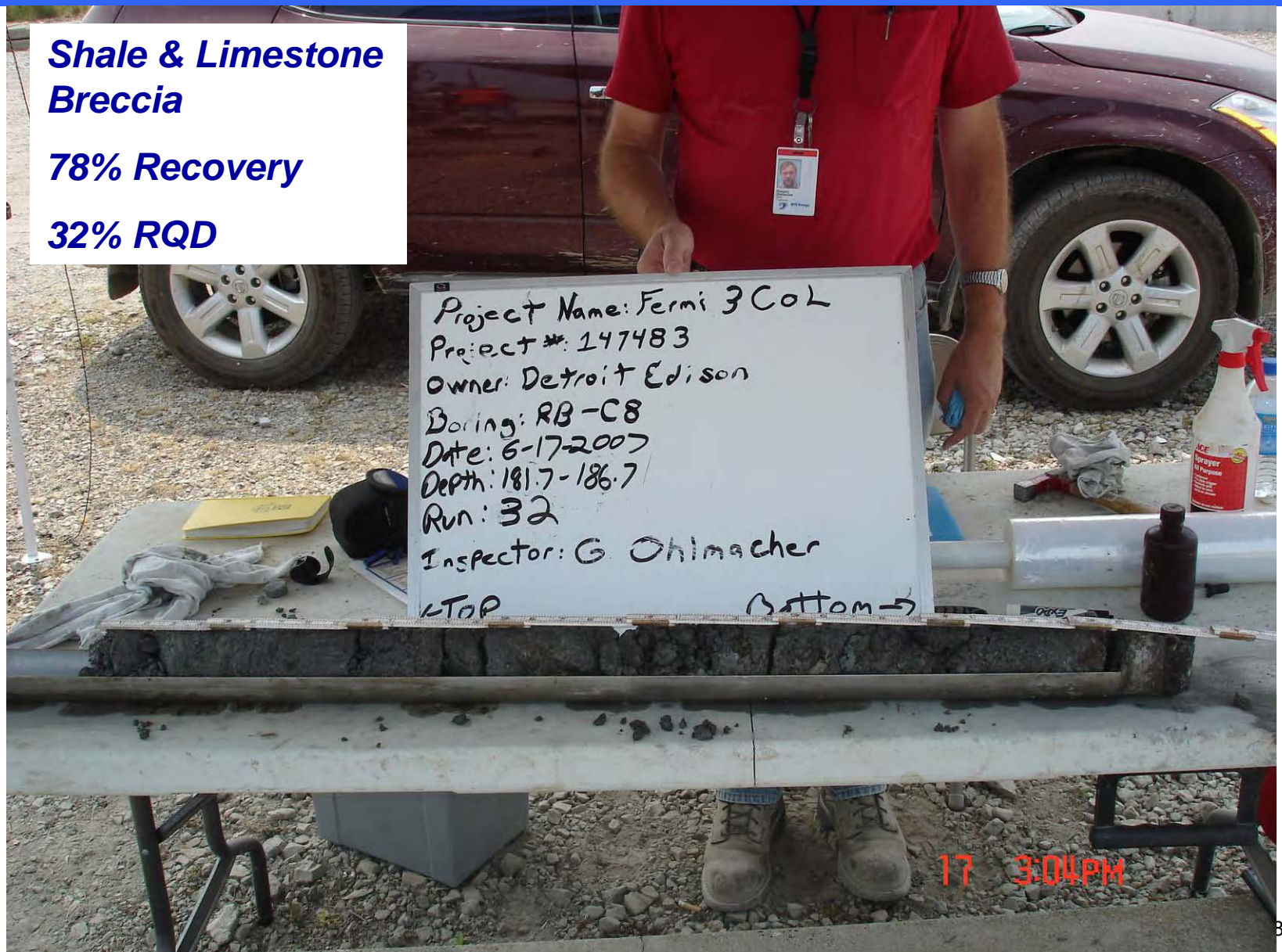


RB-C8 Salina Group Unit E

**Shale & Limestone
Breccia**

78% Recovery

32% RQD

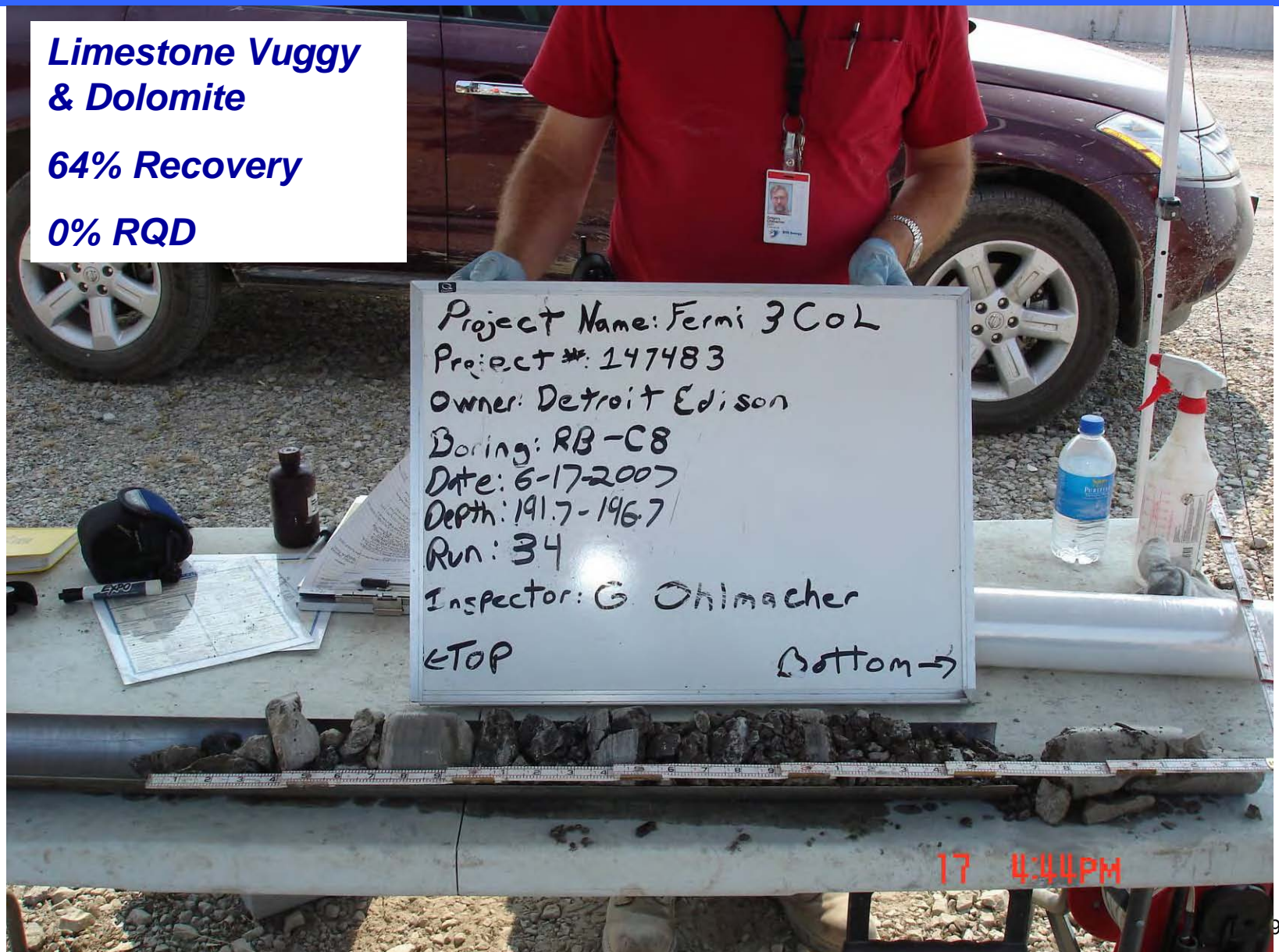


RB-C8 Salina Group Unit E

**Limestone Vuggy
& Dolomite**

64% Recovery

0% RQD

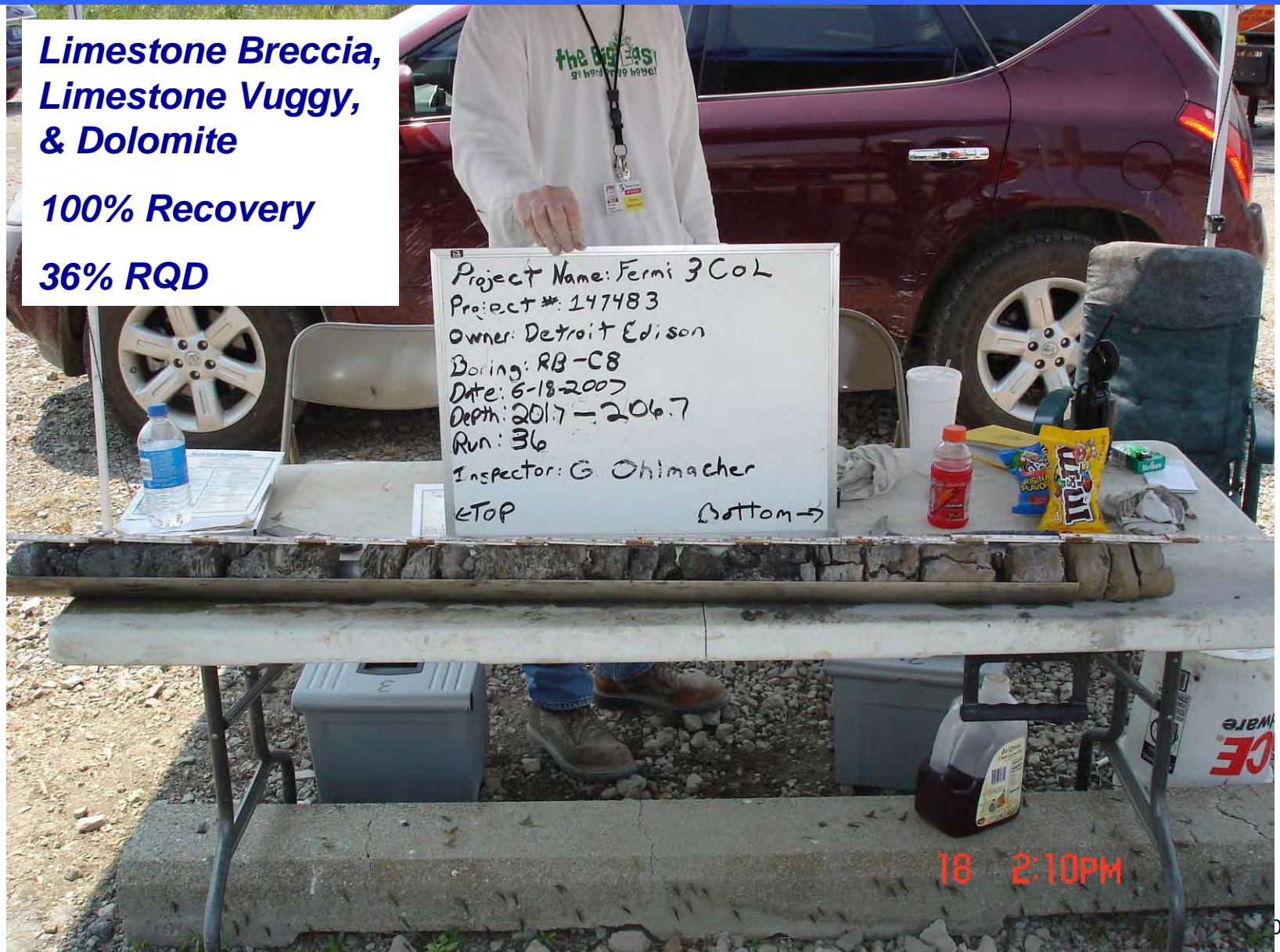


RB-C8 Salina Group Unit E-Unit C

**Limestone Breccia,
Limestone Vuggy,
& Dolomite**

100% Recovery

36% RQD

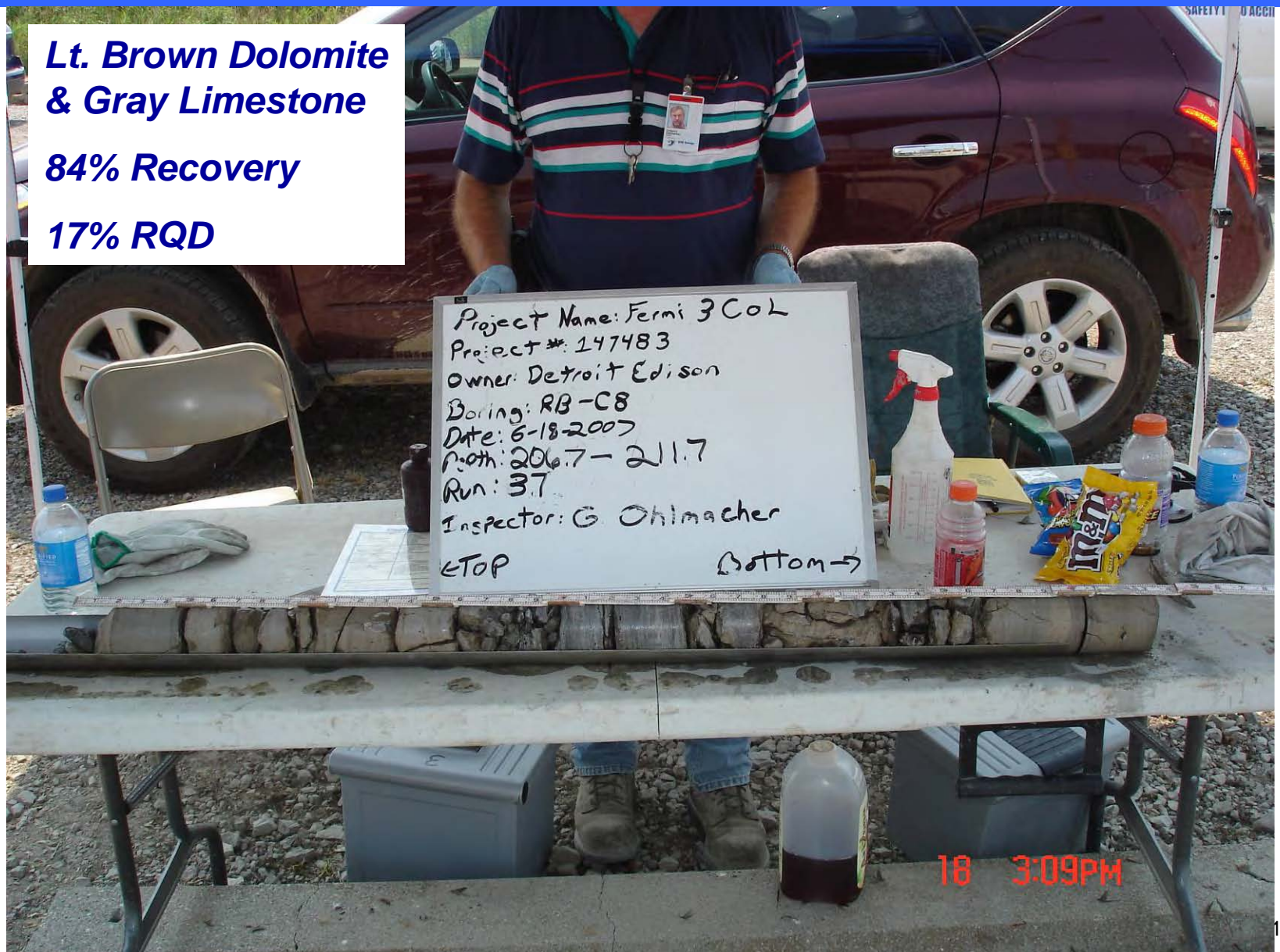


RB-C8 Salina Group Unit C

**Lt. Brown Dolomite
& Gray Limestone**

84% Recovery

17% RQD

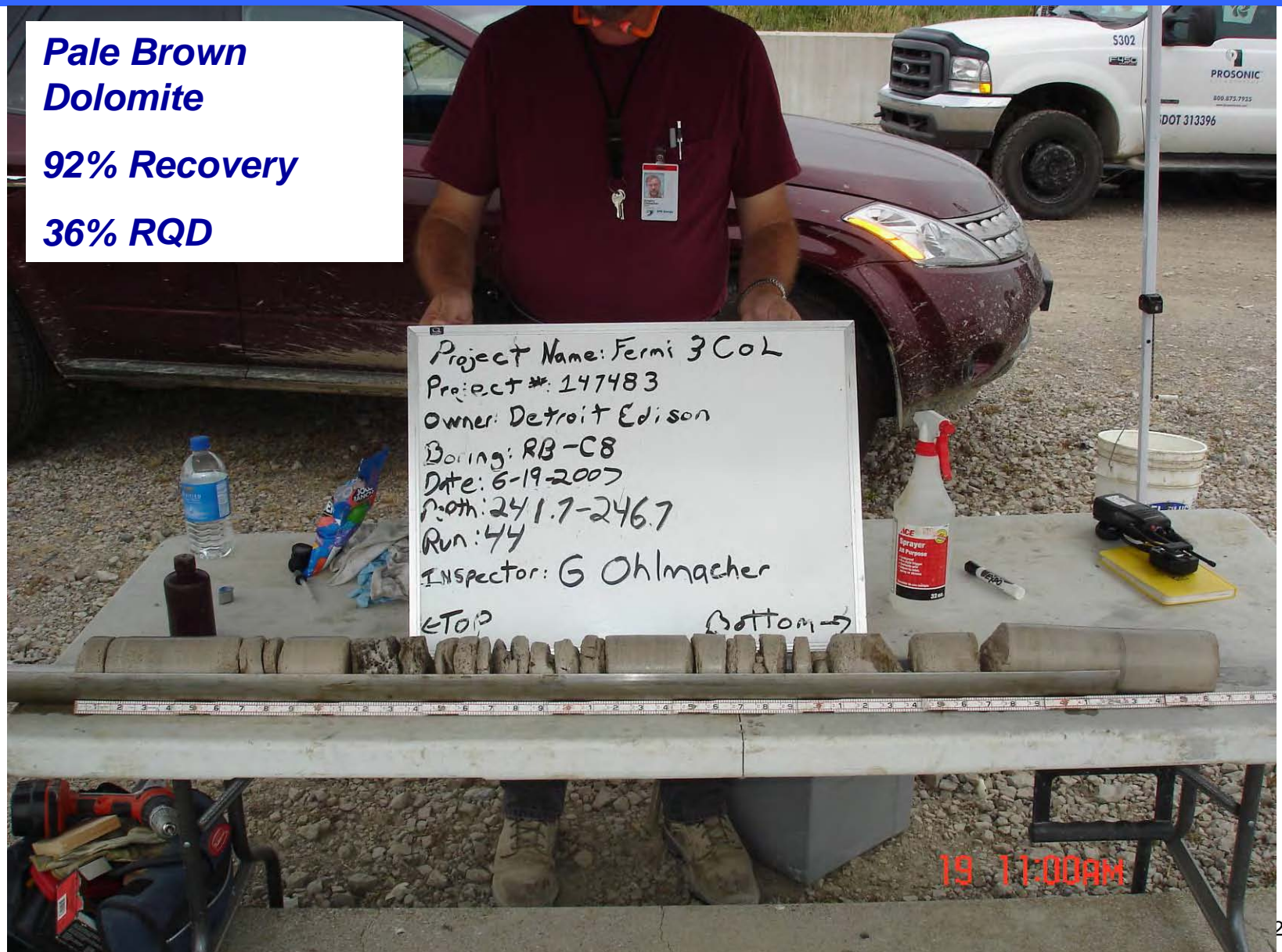


RB-C8 Salina Group Unit C

**Pale Brown
Dolomite**

92% Recovery

36% RQD

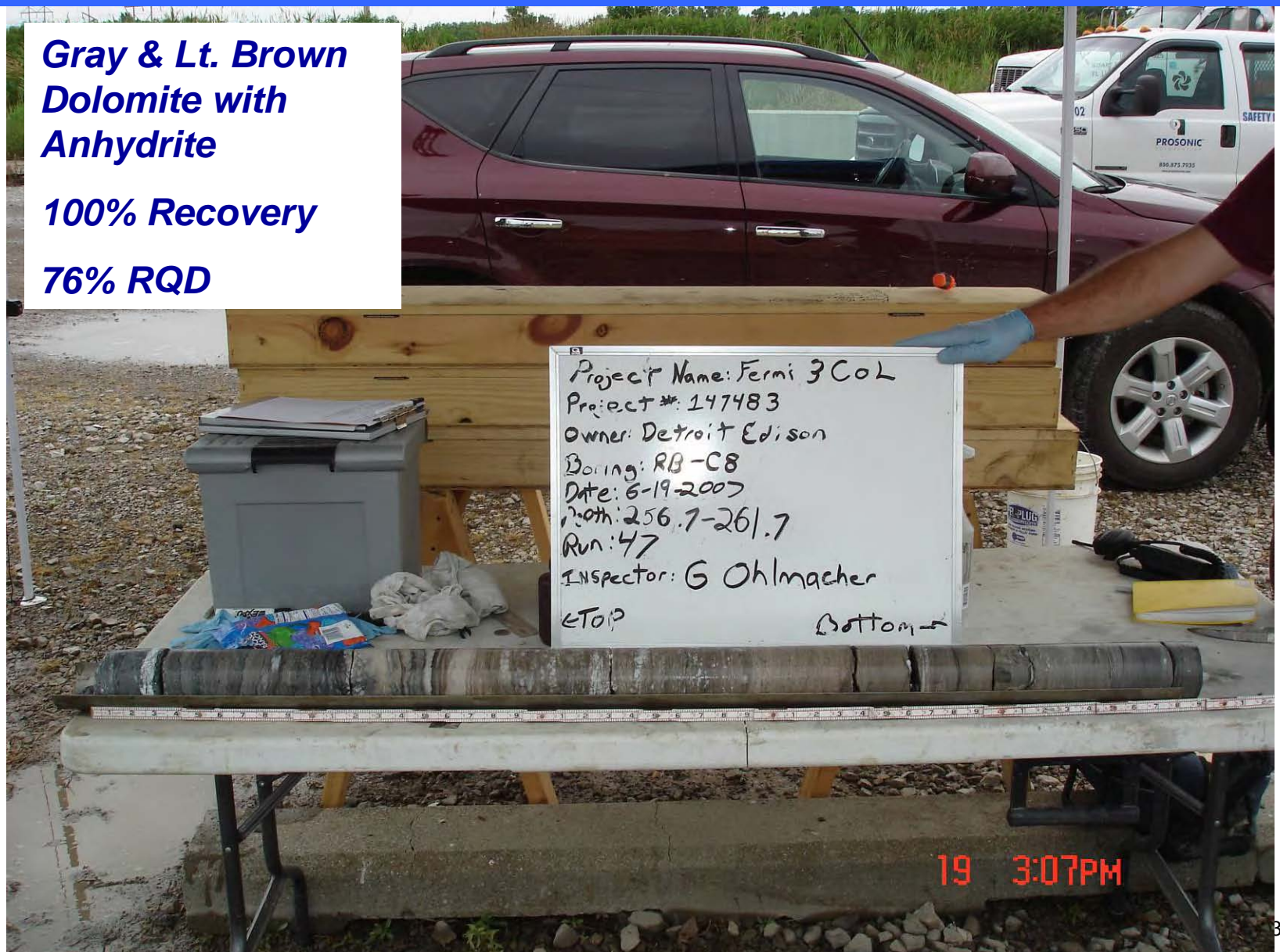


RB-C8 Salina Group Unit C

**Gray & Lt. Brown
Dolomite with
Anhydrite**

100% Recovery

76% RQD

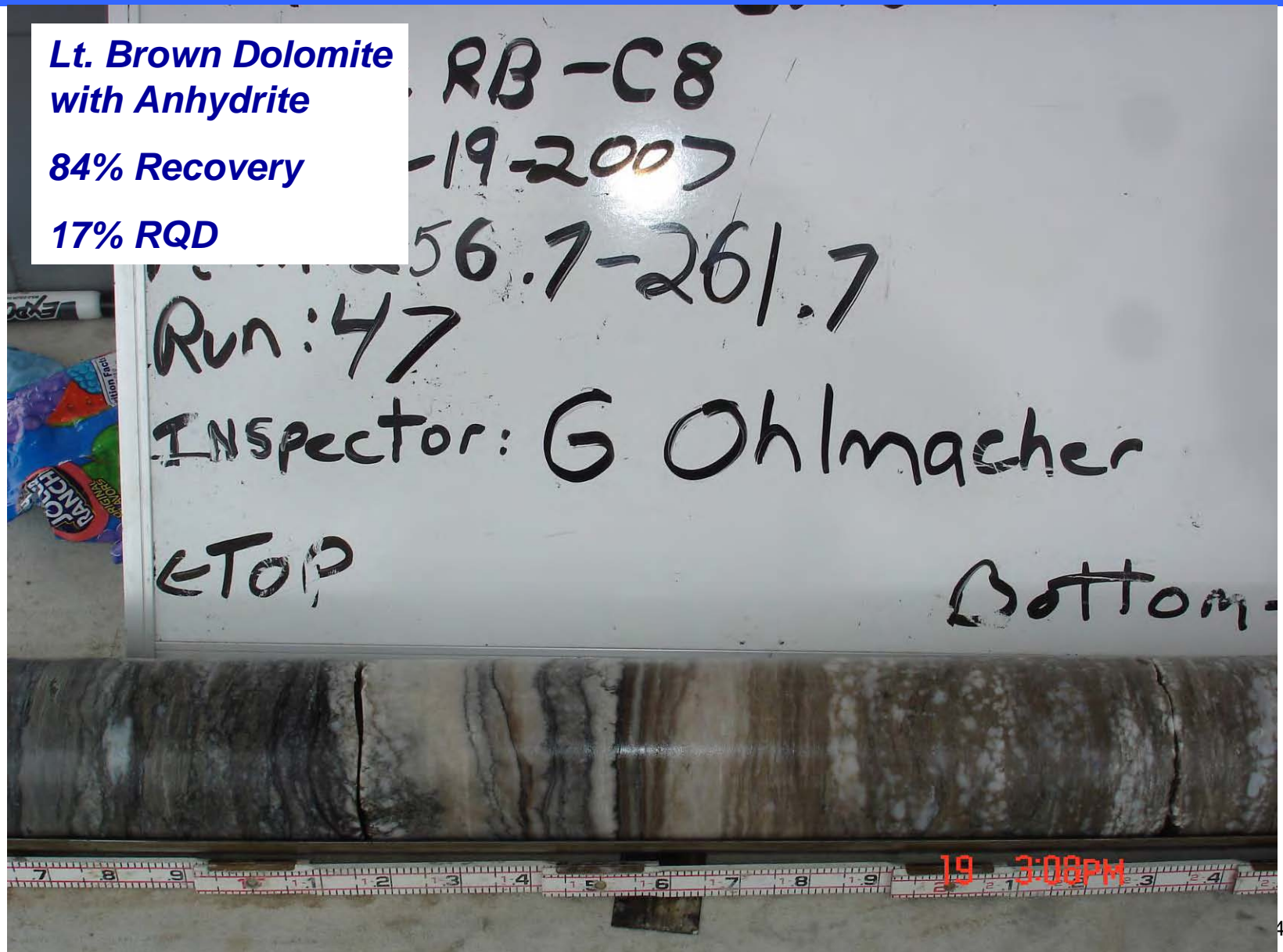


RB-C8 Salina Group Unit C

**Lt. Brown Dolomite
with Anhydrite**

84% Recovery

17% RQD



RB-C8 Salina Group Unit C

**Greenish Gray
Dolomite**

100% Recovery

100% RQD

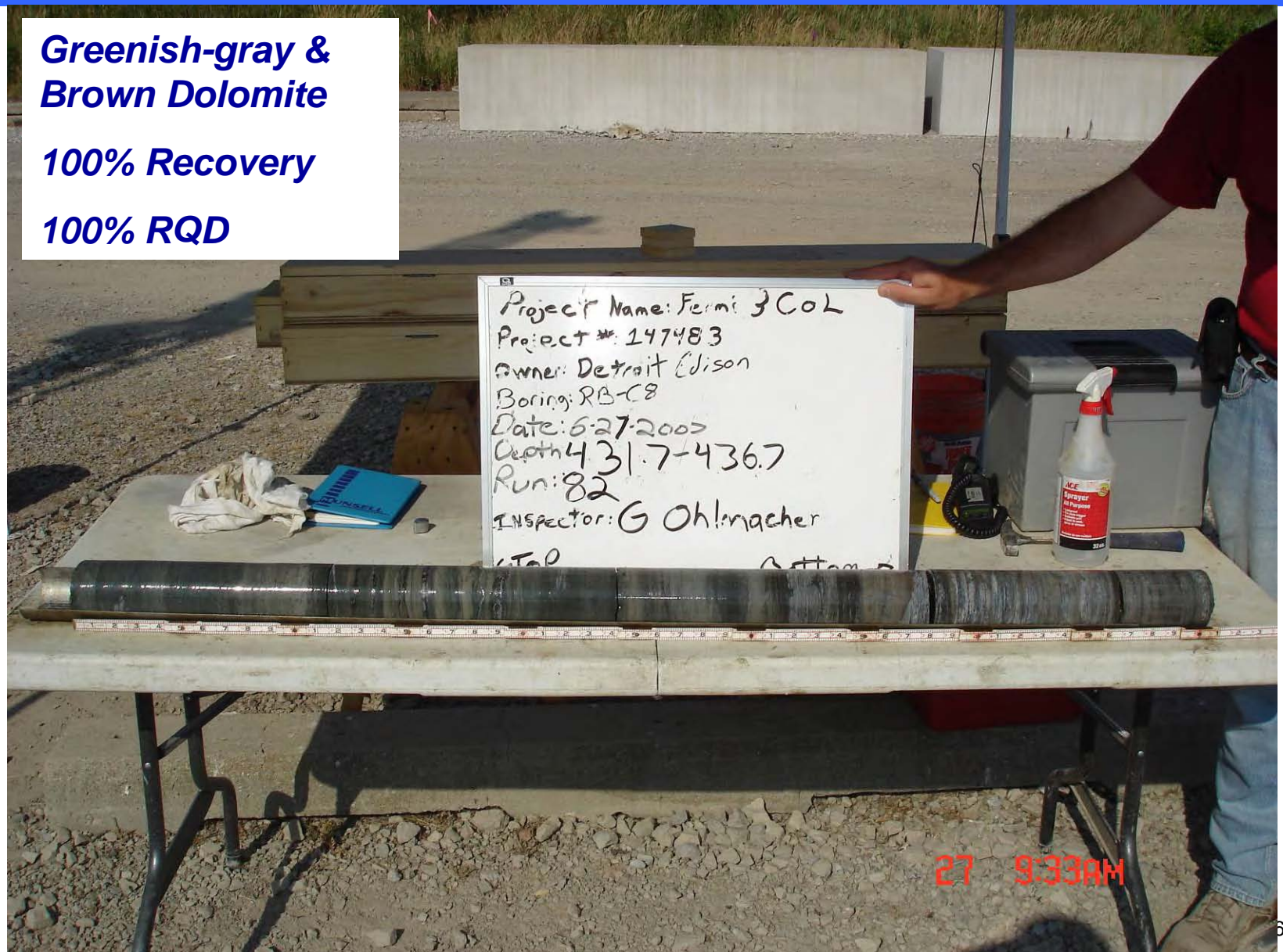


RB-C8 Salina Group Unit C

**Greenish-gray &
Brown Dolomite**

100% Recovery

100% RQD



RB-C8 Salina Group Unit A

Brown Dolomite

100% Recovery

90% RQD

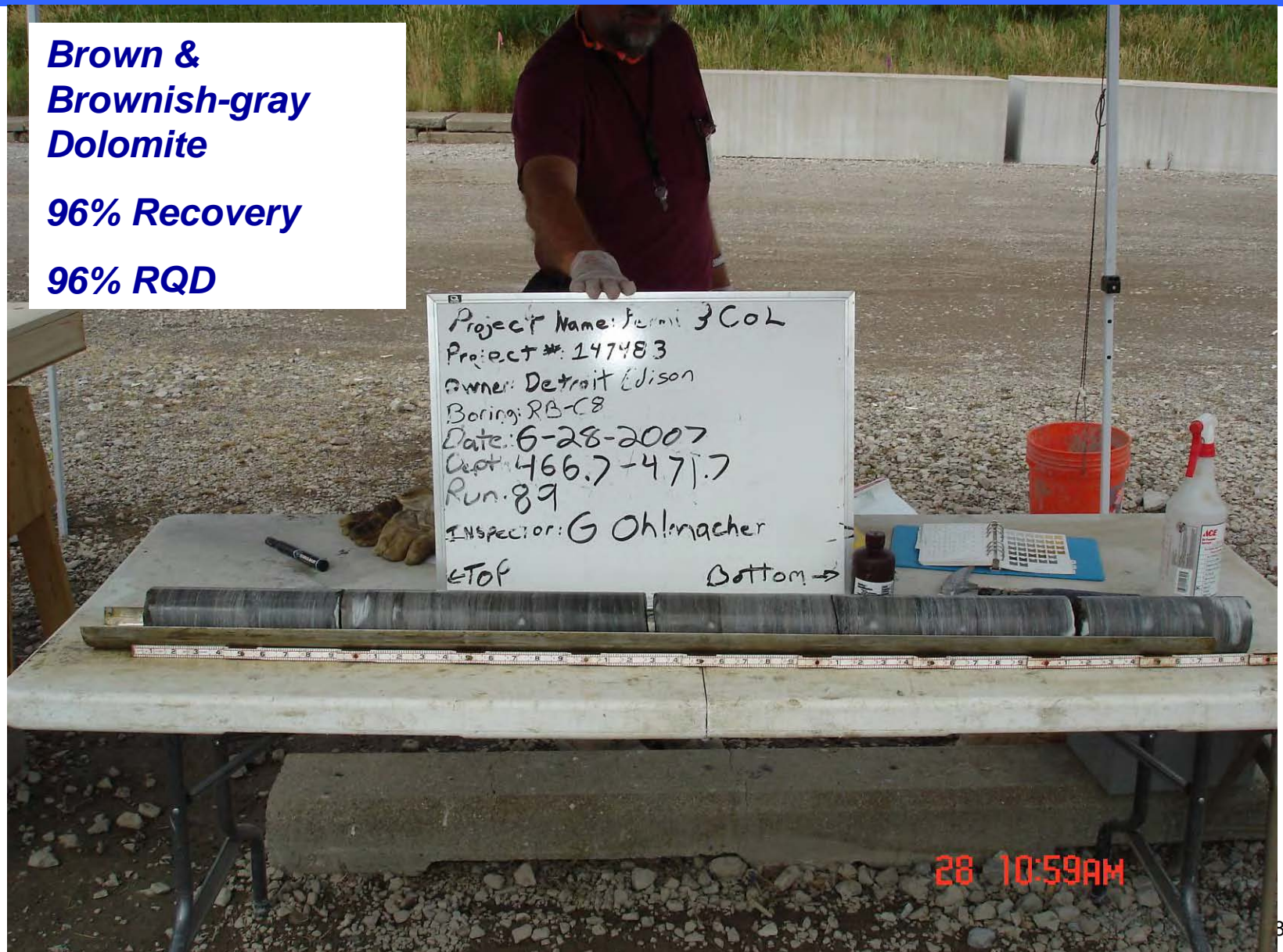


RB-C8 Salina Group Unit A

**Brown &
Brownish-gray
Dolomite**

96% Recovery

96% RQD



Field Procedures Overview

Gregory Ohlmacher
Senior Geologist
(Black & Veatch)

Beginning of Day Activities

- B&V Site Coordinator conducts daily pre-shift briefing with B&V Geotechnical Engineers/Geologist and Contractor at field office before leaving for assignment. Briefing includes:
 - General site activities
 - Safety briefing
 - Condition Reports (if any)
- Daily Site Instructions for each borehole prepared by B&V Field Engineer/Geologist and presented to drilling crew. Site instructions specify:
 - Boring depth
 - Sampling intervals & instructions
 - Boring specific testing
 - Piezometer or monitoring well installation (if required)

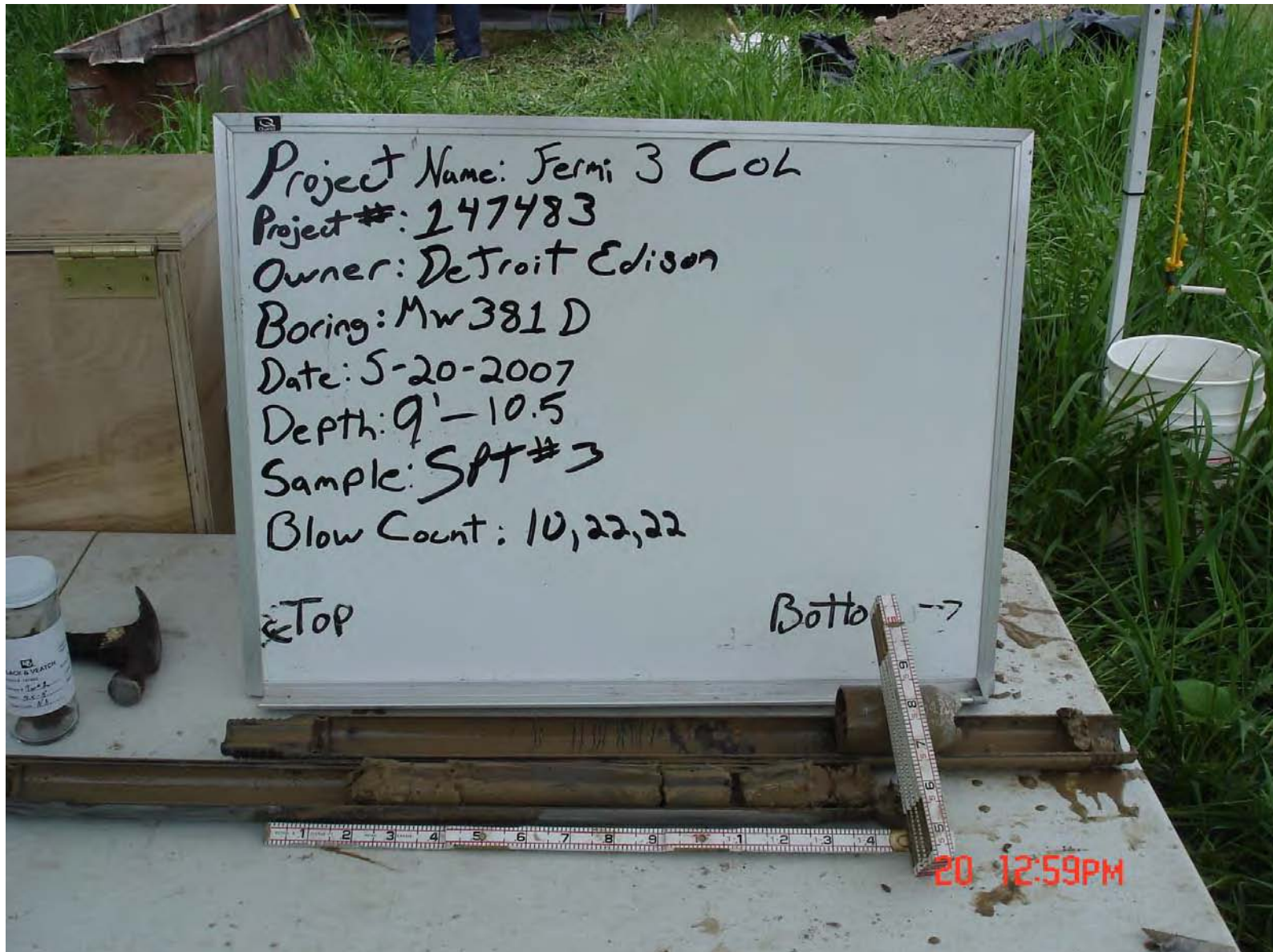
Borehole Procedure Overview

- B&V Engineers/Geologists assigned to each rig perform the following:
 - Ensure drilling or testing operations are conducted in conformance with specification and site instructions.
 - Prepare detailed geologic logs of borings, including classification of soil and bedrock recovered and description of geotechnical soil properties (ASTM 2488). Boring logs prepared in triplicate.
 - Fill out boring inspection form.

Borehole Procedure Overview

- B&V Engineers/Geologists assigned to each rig perform the following (continued):
 - B&V Engineer/Geologist inspects equipment and samplers, and records inspection activity on In Situ Sampling Test Inspection form.
 - Photograph each sample obtained.
 - Oversee any additional testing or piezometer/monitoring well installation per site instruction.
 - Oversee grouting of the borehole when completed.

Example Soil Sample Photo



Example Rock Core Photo



End of Day Activities

- Return field records and all samples to the temporary site storage facility.
- B&V Engineer/Geologist fills out Sample Custody Record.
- Partially completed field records are stored in a secure location.
- B&V Engineer/Geologist copies completed portions of field log book and files them on a routine basis.

Laboratory Testing Procedures

- B&V Engineer reviews borings, assigns appropriate laboratory testing, and submits a laboratory test request to Contractor.
- Soil/rock samples are transported to laboratory for testing.
 - Samples are transferred using the Sample Custody Record.
 - Copy of boring log sent with samples.
 - Laboratory signs for receipt of samples.

Current Site Activities

- Borings
 - Drilling at the following Borings:
 - TB-C5
 - RB-C4
 - RB-C9
- Piezometers/Monitoring Wells
 - Monthly Groundwater Level Measurements
 - Groundwater Sampling



QUESTIONS?



Site Orientation

Barry Gustafson
Site Coordinator
(Black & Veatch)

Safety Requirements

- Required PPE
 - Hard Hat
 - Safety Glasses
 - Safety Shoes
 - Gloves (when handling material or tools)
 - Hearing protection in areas of 85 decibels or higher (when near drill rig)

Safety Requirements

- Vehicle Safety
 - Obey state and site laws.
 - Always wear a seat belt in a moving vehicle.
 - Remove keys from an unattended vehicle.
- Barriers
 - Do not cross barrier without permission of workers inside.
- Slip and trip hazards
 - Uneven terrain.
 - Equipment in the area.
 - Muddy conditions.

Safety Requirements

- Peer checking
 - Take a safety minute to check you co-workers to assure PPE compliance.
 - Use questioning attitude when in doubt of a situation.
- Emergency preparedness
 - If alarms sound, listen for instructions and proceed to the assembly area.
 - In the event of a injury or fire notify the Site Coordinator.